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MANAGEMENT
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NATIONALE SUR
LA GESTION
DES DÉCHETS

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Les 3, 4 et 5 octobre 1990
St. John's (Terre-Neuve)

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Managing NIMBY in the 1990's:
Principles and Cases for Waste Managers

by

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Introduction

From coast to coast, waste management projects have been blocked by virulent outbreaks of the so-called NIMBY (Not-In-My-BackYard) syndrome, a combination of social, psychological and economic factors which seems at times to have the characteristics of a virus — powerful, invisible to the naked eye and very difficult to treat.

As existing landfills reach capacity, siting new facilities becomes a crisis in hundreds of communities across Canada. What can waste managers do to prevent and deal with the NIMBY reaction in their communities?

This brief paper seeks to provide some understanding of the NIMBY syndrome, presents some principles to deal with it and illustrates these principles with some case experiences.

The NIMBY Syndrome

The first step in managing NIMBY in the 1990's is to understand its basic components. Since 1981, researchers and practitioners have identified three major elements:

Psychological Factors

1. Selective Perception — most people see their garbage truck going down the road, but never see where it is going to. They have no systematic appreciation of waste management in their community and the often impending crisis generated by them and their neighbours. Ignorance fosters the NIMBY response.

2. Perceived Risk — how toxic is leachate and stack effluent? Who believes that "dilution is the solution"? In many cases the actual technically-based risk may be quite small, but some members of the public picture nightmares happening in their community. The media can spread these fears widely, after which it is often difficult to communicate technical data.

3. Perceived Inequity — is it fair that some people should have to put up with the noise, dust and smell of a nearby facility while others enjoy "out of sight, out of mind" ? Regardless of the economics and the legalities, it often just doesn't seem fair that some people get the benefits and others the disbenefits and nothing is done to recognize the difference.

In short, it's true that "Perception is Reality" — what people believe about their waste management situation determines their support for or opposition to your plans.

Sociological Components

1. Loss of Community Identity — in the traditional community, individuals were part of families and were knit together through church affiliations, work groups and recreational organizations which formed the social fabric of the community. Increasingly today, individuals live alone and have few organizational ties. When this is coupled with frequent migration in and out of communities, the pervasive sense of "we" which constitutes community identity fades away. Lone individuals easily become careless about the well–being of others and are ripe for NIMBY attitudes and actions.

2. Loss of Involvement and Control — how many people voted in your last municipal election ? In the City of North Vancouver, it was just 13%. What about participation in community associations and other local groups ? As community identity deteriorates, community involvement declines and residents sense they no longer have control over their lives. When people have no sense of involvement in resolving waste management problems, it is easy for them to cast the whole burden of responsibility on the shoulders of their officials — and then shoot down their proposed solutions.

3. Lack of Regional Affiliation — if community identity is weak, then regional identity is almost nonexistent. In many cases, waste management solutions call for the co–operation of a number of communities across a region — but this assumes some level of shared understanding, mutual confidence and joint goals. Often regional government seems to mean a common battleground rather than a centre for co–operation. NIMBY flourishes under these conditions.

Economic Dimensions

1. Feared Loss of Property Values — while residents may be unaware of some of the above factors, or reluctant to admit them, the potential loss of property values is a popular rallying point for NIMBY reactions. This concern is frequently adopted by people some considerable distance from a facility or its haul routes.

2. Lack of Compensation — frequently, mechanisms exist for setting compensation for those whose land is needed for a new facility, but there is nothing available for those adjacent to the plant or residents of the surrounding neighbourhood or municipality. This situation fosters the rejection of waste management facilities.

Clearly, the NIMBY syndrome results from a complex and inter–related set of psychological, sociological and economic factors which are not always easily recognized, understood and dealt with. However, managers must manage, so the following principles are designed to provide some guidelines for those responsible for waste management in the 1990's.

Principles for Waste Managers

1. Understand your community.

Since you cannot manage what you do not understand, it is important to acquire a systematic and comprehensive understanding of the community or area for which you are planning. Specifically, you need to identify the various publics for waste management (there may be a dozen) and discover the relevant leaders and organizations for each. What do each of these different publics know and believe about waste management in this community and about your organization's capacity to deal with it ? What are the key communication channels for each public ? What about attitudes to growth and change ?

The community is an important player in waste management planning and decision–making. Communities have great survival capacity; they will take the steps necessary to ensure the well–being of most of their members, including disciplining self–interested minorities. In many cases, the community is a sleeping giant which must be identified, aroused, informed and involved in resolving waste management problems. Local communities are often linked into a regional community, though the linkages may need maintenance work before useful activities can be carried out. (See our outline of the Social Profile in our Resource Book as one way to assemble a systematic and comprehensive understanding of your community.)

2. Educate your community

Waste managers need the informed support of most of their publics if their plans and operations are to receive the necessary public and political endorsement to proceed. Given the understanding of the community provided through #1 above, what is your situation ? Probably a few publics are both informed and supportive, some are likely uninformed and opposed, while the majority will quite often be uninformed and indifferent.

Develop an educational strategy which will include: setting priorities amongst these publics, identifying potential resources in the community, formulating an information plan for each public, securing the resources to implement these plans, taking action and evaluating the results in order to improve the effectiveness of these activities. (In many ways, this can be seen as public sector marketing – for a practical approach, see the Lovelock and Weinberg reference. Alternatively, see "Preventing and Resolving Public Controversy" in our Resource Book.)

The subject matter of this educational program will vary with each community, but it will probably include a summary of the present situation, the outlook for the short and longer run future needs and a review of alternative technologies for waste management. Recognition will have to be given to methods of waste reduction, reuse and recycling or skeptics will write off dependency on traditional landfills as totally unacceptable. Information will need to be provided at several levels to accommodate the questions of resident scientists as well as those of people with less than high school education. (Remember that 20% of Canadian adults are functionally illiterate.)

Ignorance breeds misperceptions, fear and hostility. These can be prevented by an early and proactive education program as suggested above. If these problems are neglected until they are fully established, overcoming them will be lengthy, costly and sometimes impossible.

3. Involve your community

Increasingly today, people want to be involved in making plans and decisions which affect them. To develop technical plans without informing the public and providing those interested with opportunities to ask questions, make comments and register their views is asking for trouble. While Edmund Burke–type politicians, who want to exercise their responsibilities freely and directly without "interference" from the public, dislike participative planning, the "union delegate" kind of politician finds it very appropriate.

In many cases when a community issue arises there will be a small proportion who favour it, a small proportion who oppose it, e.g. NIMBYs and large silent majority. Our basic strategy is to identify, interest, inform and involve the usually silent majority and have them provide visible, informed, majority support for a solution to the community issue. We encourage this support group to deal with the minority opposition.

There is a well–established social technology now for public involvement, typically using a sequence of responsive publication, open house and perhaps a planning workshop or telephone survey. This sequence may be used at the introductory phase, alternatives generating phase and decision phase of a planning process. (For further information, see our Resource Book or our new 25 minute instructional videotape: "How to Prevent and Resolve Public Controversy.")

4. Ensure your proposals are equitable

While most publics are the beneficiaries of a waste management plan and will tend to support it, you may lose their support if the plan is perceived to be unfair to the immediate neighbours of the facility or those in the surrounding area. A social impact assessment study, formal or informal, is one means of identifying the impacts and arriving at appropriate measures to offset them; these measures may involve financial compensation or may take the form of new facilities which benefit the neighbourhood. In most cases, everyone must give something so that everyone may gain something — in this case, a good waste management system.

Providing the immediately affected neighbourhood and others concerned with access to information and funds to hire independent experts to evaluate a plan are important aspects of an equitable approach. Community monitoring of site operations and representation on the body governing the facility so that complaints can be dealt with directly add to the evident fairness of a management plan. These actions increase residents' sense of control, a key NIMBY factor noted earlier.

5. Encourage your supporters, not your adversaries

Invest most of your time and resources on identifying, interesting, informing and involving the beneficiaries of your waste management program so that they become vocal and visible supporters of it. Do not spend more than 20% of your resources trying to convert your opposition — many are locked into an ideological position; the more attention you give them, the more important they feel. Instead, let community supporters deal with them through peer group influence.

Case Experience

Rather than present a single case study, as we did at the eighth conference in this series in Halifax in 1986, I would like to illustrate each of these principles by drawing on several waste management projects.

1. Understand your community

In the mid–1970s we found it impossible to design and manage public consultation programs effectively without a systematic social data base. Relying on local authorities left us vulnerable to their biases and hidden agenda; sample surveys were too slow and costly. We therefore devised the "social profile" to provide a strategic summary of the key characteristics of a community in a form a practical manager could use. This was to be accomplished in no more than 10 days, regardless of the size of the community.

The standard chapter heads are: local history; industries and occupations; development issues including attitudes to growth; organizations and leadership; communication channels; knowledge of and attitudes to the client, industry and project; publics affected; observations and conclusions.

In the Lower Mainland Refuse Project (LMRP) in 1983–84, social profiles of the three regional districts involved clearly indicated the commitment of key people to the 4Rs and their willingness to contribute both dollars and personal effort to achieve a more environmentally sound waste management program.

A secondary benefit was that the personal contacts developed by the researchers in gathering this information proved most valuable to gain the co–operation of environmental group leaders in joining technical committees and participating in a series of planning workshops. (See "Involving the Public in Solid Waste Management Planning" with Ann C. Svendsen in our Resource Book.)

In our earlier Halton Landfill Project in 1975–76, the social profile made it clear that the traditional affiliations of residents to the four townships which made up the relatively new Halton Region were so strong that it was necessary to have open houses in each. The weak affiliation of residents with Halton Region, noted in the profile, was one of the factors which led to later difficulties with that project. (See "The Halton Region Landfill Case" in our Resource Book.)

2. Educate your community

In each of the above cases, a substantial and systematic program of information and feedback was developed, although quite different given the nature of the two situations. In the LMRP case, the mutual education process led to engineers becoming more open and committed to the 4Rs, as well as to citizens learning more about waste management technology. As a result, the final report did not feature the customary emphasis on landfill, but rather gave it a residual role after significant resources were recommended for waste reduction, recovery, re–use, and recycling.

In the Halton case, the NIMBY syndrome was disproven, in that Site G was rated best in all four municipalities by the 2,500 postcards mailed by residents. In addition, Oakville residents rated Site C second although it was located within that community. Our deficiency in this case was that, the public consultation program having been essentially imposed on the Region by the Province, we were unable to persuade the Region to continue the program as was needed to deal with the specific concerns of the neighbours of the finally selected site, i.e. Site J. The classic NIMBY action followed.

A unique education process took place in Alberta to locate a site for its Hazardous Waste Treatment Centre. Following a province–wide information program with more than 120 introductory meetings in as many municipalities in 1981, 70 communities expressed general interest, 53 requested local mapping and five requested specific consideration for actual plant siting. The final winner was Swan Hills, Alta. (Unpublished paper by Jacqueline B. Champion, former Director of Communications.)

While some programs begin with engineering studies to find a technically acceptable site and then try to engineer political assent, often with disastrous results, this program reversed the process. It first found communities which wanted the facility and then solving any engineering, transportation and economic problems which might occur in those locations.

3. Involve your community

In the LMRP and Halton cases, we provided opportunities for residents to both obtain information and to register their responses in different ways. This is necessary because people have different energy levels, attention spans and levels of commitment for planning issues. For example:

a. The Inactives — these people gain some information from mailed brochures, display newspaper advertisements, media news coverage and conversations with friends and neighbours. They will respond if interviewed through a telephone survey but not otherwise.

b. The Ten Minute People — these residents gain information through the above means and will then take 10 minutes to complete and mail a reply–paid postcard or tear–off coupon in a newspaper.

c. The One–Two Hour People — these people will read and respond like the Ten Minute People but will also visit an Open House, providing the time and place are convenient, to obtain further information and register their views.

d. The Actives — these people may be supporters or opponents, including NIMBYs. They will use all of the above mechanisms to obtain information and respond, but in addition, will seek further sources of information and other ways to register their views, e.g. participating in a planning workshop, organizing and attending rallies, contacting politicians, etc.

If the only vehicle for public information and involvement is a traditional public meeting, a project will hear only from the Actives, and most of them are likely to be negative. Yet the population of the community may well be 5% Actives, 80% Inactives and the remainder split between Ten–Minute and 1–2 Hour People. It is therefore critical to provide a broad range of information and response opportunities to overcome NIMBY problems in planning and managing waste management projects. (For examples, see the case studies in our Resource Book.)

4. Ensure your proposals are equitable

To overcome fears about excessive traffic from a new facility and the perceived losses in property values, some form of participative social impact assessment study enables a systematic appreciation of the current situation, the anticipated effect of the new plant and a variety of ways through which benefits can be maximized, impacts minimized and unavoidable effects compensated. Recent reports in Waste Age have indicated that siting success in the U.S. has been achieved when some compensatory facilities have been provided, e.g. a recreational building.

In Swan Hills, Alta., the employment, tax base and other benefits which came with the Hazardous Waste Treatment Centre more than made up for any perceived problems associated with it. Recent information indicates that the plant continues to be regarded positively by most residents.

5. Encourage your supporters, not your adversaries.

Initially in both the cases we have cited, we directed publications, open houses and work with the media to the public at large — the usually silent majority which consists of Inactives, Ten–Minute and 1–2 Hour People. These efforts bring about the greatest changes in the greatest number of people.

Having identified opposing elements through the social profile, we typically give them no special treatment in the publications and open house activities, but we invite them to participate in the planning workshop. In it, the project manager meets for most of a day with representatives of a dozen community organizations to review the project and work in a problem–solving way on issues associated with it. This has proven to be a valuable opportunity to tap the views and interests of middle–of–the–road groups as well as supporters and opponents. Typically, the positive groups bring pressure to bear on the negatives to develop and accept workable compromise solutions for remaining issues.

Conclusions

This paper has outlined the complex of psychological, sociological and economic factors which make up the NIMBY syndrome, presents five principles for guiding waste managers in dealing with NIMBY situations and provides some illustrative case experience. I will be glad to answer questions and welcome your comments and suggestions for dealing with this challenging problem.

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Use of Mediation and Negotiations Approach

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Overcoming "NIMBY": Canadian and U.S. Experiences

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U.S. LESSONS LEARNED -
SELECTING SITES FOR CONTROVERSIAL FACILITIES

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1.0 INTRODUCTION

1.1 BACKGROUND

The technical team dons bulletproof vests and proceeds under police escort to a potential site for a waste disposal facility. As they approach the site, they are met by several hundred protestors, well-trained in civil disobedience techniques, who lock arms and block their passage. A dozen reporters, cameras poised, hover nearby looking for a news story. What's wrong with this picture?

In this case, the site is only one of several that the technical team had planned to walk on to prepare for field studies. A final decision on a single preferred site will not be made for more than a year, after four seasons of site characterization studies and an environmental impact statement, all subject to public review and comment, are completed. What will happen when drill rigs and other expensive equipment are brought on the site?

We can all agree, and the literature illustrates, that the "Not in My Back Yard", or "NIMBY" syndrome has become more prevalent and widespread in the past several years. The authors of this paper have experienced several manifestations of the NIMBY syndrome in their work for industrial and governmental clients.

There is an increasing recognition that finding the technically correct solution to an environmental problem does not equate to smooth sailing during project implementation. Public involvement has become a reality of doing business in the United States today. There is a wide range of opinion about exactly what public involvement is, when it is appropriate and even exactly who "the public" is. However, governmental agencies have come to accept public involvement as a necessary part of successful programs, and industry is learning that ignoring public concerns can have a very real effect on the corporate image and bottom line.

1.2 OBJECTIVES OF THIS PAPER

This paper has the following objectives:

- To explore history and trends related to public involvement in the United States.
- To illustrate successful techniques that can be used to break "log jams" associated with siting of controversial facilities.
- To identify emerging trends and research needs, so that informal discussions during this conference and other like it can advance the state of the art in public involvement.

2.0 DEFINITION AND HISTORY OF PUBLIC INVOLVEMENT IN THE UNITED STATES

2.1 WHAT IS PUBLIC INVOLVEMENT?

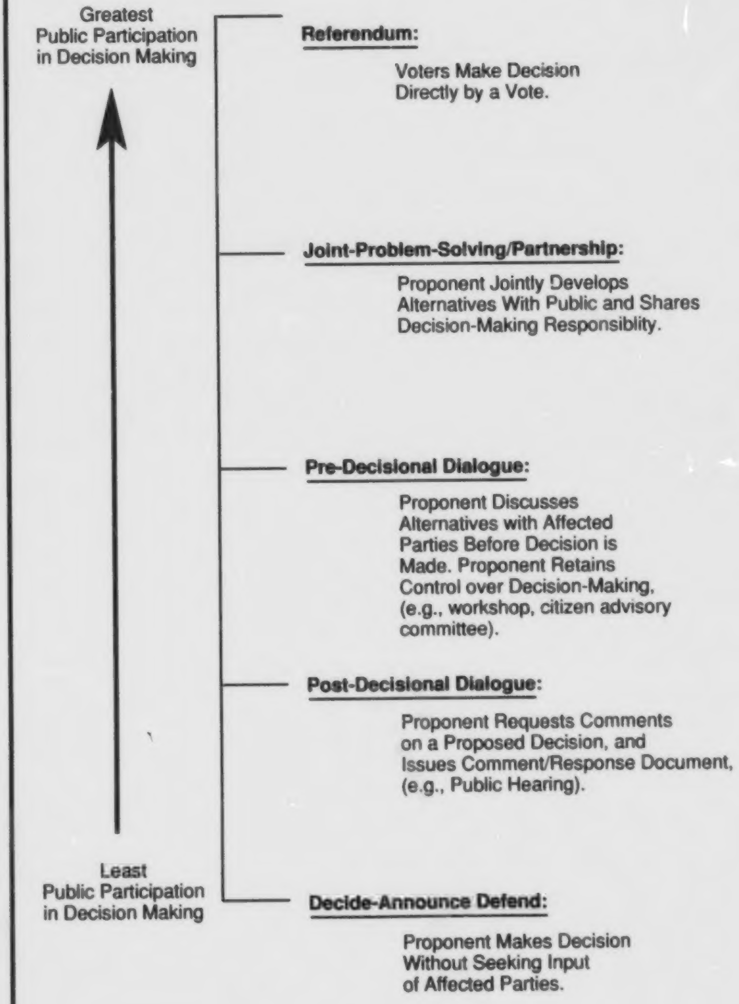
Public involvement is a systematic process that provides an opportunity for project proponents and the "public" to exchange information and work together to develop an acceptable plan or program. Public involvement is not selling a pre-determined solution by public relations techniques, or one-way communication (telling people what is best for them).

Public involvement programs are designed to:

- Add to the legitimacy and public acceptance of decisions (e.g., combat the NIMBY syndrome).
- Comply with regulatory requirements.
- Promote better decision-making. Companies are learning that citizens have good ideas and can provide valuable local information -- they are not exclusively bent on blocking a plan or project. Citizens also provide an outside perspective and unusual kinds of expertise, and have a longer range view than most elected officials. Public involvement programs also allow values and preferences to be incorporated into decisions.

Meier et al. (1990) have developed a public participation continuum, presented in Figure 2-1, to illustrate the various levels of public involvement in decision-making. The greatest public participation occurs when voters make a decision directly, through a referendum process.

In contrast, the least involvement occurs when a project proponent follows the "decide-announce-defend" approach popularized by Larry Susskind and his associates at the Massachusetts Institute of Technology and Harvard University. In this case, the decision is made without first consulting with the public. A vigorous attempt to establish the legitimacy of the decision (e.g., sell), through



Greatest
Public Participation
in Decision Making

Referendum:

Voters Make Decision
Directly by a Vote.

Joint-Problem-Solving/Partnership:

Proponent Jointly Develops
Alternatives With Public and Shares
Decision-Making Responsiblity.

Pre-Decisional Dialogue:

Proponent Discusses
Alternatives with Affected
Parties Before Decision is
Made. Proponent Retains
Control over Decision-Making,
(e.g., workshop, citizen advisory
committee).

Post-Decisional Dialogue:

Proponent Requests Comments
on a Proposed Decision, and
Issues Comment/Response Document,
(e.g., Public Hearing).

Least
Public Participation
in Decision Making

Decide-Announce Defend:

Proponent Makes Decision
Without Seeking Input
of Affected Parties.

SOURCE: Meier et al, "Public Involvement: Keystone to Public Confidence in the Civilian Radioactive Waste Management Program," in Waste Management '90, 1990.

FIGURE 2-1 PUBLIC PARTICIPATION CONTINUUM

a public education and media campaign, is then mounted.

Often, potential losers are galvanized to form vocal opposition groups and the project winds up in court. Officers of the court typically have less technical expertise than other participants, and may be forced to rule on procedural matters that have nothing to do with the merits of the proposal. In addition, the legal system often does not seek to address legitimate concerns or find a solution to the problem: it picks a winner and a loser.

As one moves up the continuum, there is an increase in the amount of information exchanged and, eventually, true involvement: a sharing of power in decision-making.

2.2 PUBLIC INVOLVEMENT IN THE UNITED STATES - A BRIEF HISTORY

Table 2-1 summarizes the evolution of public involvement in the environmental field in the United States during the last 40 years. Public involvement trends are shown in the context of the growth in environmental awareness and the mood of the public. Clearly, there is a trend toward more public involvement in increasingly complex technical decisions. Some explanations for this trend are highlighted below.

Crisis of Public Confidence in Government and Industry -- Decreasing trust in government and industry has resulted from both coverups of problems at industrial and military facilities, and from failure to protect workers and the public. The loss of confidence has resulted in an increased demand for information about activities, and less willingness to accept national security, patent protection, and privacy as reasons for secrecy.

Growing Public Awareness of Environmental, Health, and Safety Issues -- The public has an increasing awareness of the risks and potentially harmful by-products of technology. The discovery of past mistakes (e.g., Chernobyl, Love Canal, Times Beach) and the wide publicity of recent disasters (e.g., Bhopal, Exxon Valdez, the Challenger space shuttle) have contributed to this concern. Media and satellite communications have increased awareness -- issues now transcend international borders. There is also an increased recognition of global environmental relationships (e.g., global warming and rain forests).

Changes in Society and Lifestyle -- Increased democratization and freedom of speech around the world have led to the growth of international environmental/ social movements and the consequent demand for a voice in decision-making. In the United States, lifestyle changes include increased urbanization, more heterogenous populations resulting from greater mobility, and a lost sense of community. The rising standard of living and the faster pace create a demand for convenience foods and products and increase waste generation and energy consumption.

Technical Complexities and Uncertainties and Tradeoffs Create the Need for Public Involvement in Decision-Making -- Debates among scientists over areas of technical uncertainty have created confusion. Science has lost its aura of objectivity and rationality, and the integrity of scientists has become an issue.

Events of the Decade	The Public's Mood	Predominant Public Involvement Strategies
1950's - Economic Optimism and Growth		
Post-war era: rise in industrialization and standard of living.	Trust in government and industry. Focus on growth - not environmental impacts.	Decide-announce-defend. Limited public involvement in decision-making.
1960's - Rise in Environmental Awareness		
Silent Spring by Rachel Carson, 1962.	Awareness of inter-relationship of people and the environment.	Limited involvement of public or independent technical experts in decision-making.
Civil Rights Movement - 1964; Vietnam War Protests.	Protest and demonstration - demand to be heard.	
Man Lands on the Moon - 1969.	Fragility of Spaceship Earth recognized.	
1970's - Era of Regulation		
Earth Day, 1970. Flurry of national environmental laws: NEPA, CAA, CWA, RCRA, SDWA, etc.	Demand to protect the environment.	Regulations require public notice, access to information, public hearings (Passive procedures: burden on citizens to inform themselves).
Freedom of Information Act - 1974; Government Sunshine Law - 1977.	Increased demand for information and input, access to meetings.	Regulations require agencies to solicit input immediately before decision. (Public comment period).
Courts liberalize rules of standing - 1977.	Frustration and dissatisfaction.	Increased number of judicial actions by advocates of public interest.

TABLE 2-1 EVOLUTION OF PUBLIC INVOLVEMENT IN THE ENVIRONMENTAL FIELD IN THE UNITED STATES

Events of the Decade	The Public's Mood	Predominant Public Involvement Strategies
1980's - Era of Intervention and Disillusionment		
Scandals at EPA, HUD; Iran Contra Affair.	Distrust in government.	Intervention in government proceedings.
Environmental disasters: Chernobyl, Bhopal, Exxon Valdez.	Distrust in industry.	Demand for restitution and disclosure leads to more regulations (e.g., SARA Title III).
Awareness of potentially harmful effects of by products of technology.	Demand for voice in policy-making.	Advisory committees formed with mixed success.
Stringent regulations require closure of existing facilities, increase need for siting new ones.	NIMBY. Focus on pollution prevention and waste minimization.	Protests/demonstrations, followed by lawsuits against opposition groups.
Rise in democracy in Eastern Europe.	Demand for information and larger role in decision-making.	Sharing of decision-making power recognized as an option: negotiation, local oversight and control, compensation.
1990's - Era of Enlightenment and Creativity		
Earth Day - 1990.	Global perspectives on environmental crisis.	Government and industry willing to share information and power to rebuild trust and gain public acceptance.
Complexity of environmental issues increases: acid rain, global warming.	Willingness to pay more for environmentally safe products.	Use of media/public relations to educate the public about environmental issues.
Greening of corporate America: recognition that public environmental concerns have a real impact on image and the bottom line.	Most are willing to protect/cleanup the environment - even if it means higher taxes and a loss of jobs.	Innovative approaches: - Independent citizen watchdog group (Aleyska). - Local control and shutdown authority.

TABLE 2-1 (CONTINUED)

Scientists see "irrational, hysterical" reactions to factual situations and risk calculations. The public reacts to scientific debates with its emotion. A social scientist speaking recently to a group of nuclear waste specialists said, "We do science. They have values."[1] Determination of the acceptability of risks associated with technology involves personal and social judgments, and reconciling varying positions is a tough job.

High Cost of Environmental Protection and Clean-Up -- An evaluation of priorities, and the "trade offs" involved in different courses of action, is necessary because of the magnitude of problems and resource limitations. A broad perspective is necessary to establish the national environmental agenda.

Public Expectations -- The public is demanding a larger role in decision-making. In fact, in some ways citizens are taking back decision-making authority previously delegated to technical experts and elected officials.

3.0 FACILITY SITING AND PUBLIC INVOLVEMENT

In this section, an overview of the regulatory and political environment in which facility siting is occurring in the United States today is presented. Several examples that illustrate public involvement strategies are then presented.

3.1 WHAT FACILITIES ARE BEING SITED?

A recent survey of American urban residents indicated that of a list of 28 public facilities, none was welcome in the same block as their own homes, and only one facility, a park, was welcome in the next block. Only two other facilities -- a public library and an elementary school -- were welcome in the neighborhood.[2] These findings do not bode well for the siting of more controversial facilities, such as incinerators, waste disposal facilities, and industrial plants.

Some environmental activist organizations do not accept the premise that waste disposal facilities have to be sited. For example, the philosophy of the Citizen's Clearinghouse for Hazardous Waste is that every time a new facility is built, polluters have another excuse to keep polluting. They believe that if activists succeed in stopping the siting of a facility, polluters will be forced to develop a better alternative.[3] Most government agencies and industries disagree with this philosophy and are continuing to try to develop new and better waste disposal facilities. Several trends in facility siting in the United States are apparent.

More Stringent Regulations Force the Closure of Existing Facilities

The federal Resource Conservation and Recovery Act requires hazardous waste land disposal facilities (e.g., landfills and impoundments) to be closed or retrofitted with double liner and leachate collection systems. Similarly, state regulations have forced closure of municipal solid waste landfills. As landfills in the eastern United States have been closed, garbage has been transported out-of-state to private landfills in the midwest. Several states have attempted to pass laws to keep out-of-state wastes from being dumped inside their borders, and are being challenged in court on the basis that such bans violate the interstate commerce clause of the U.S. Constitution.

Federal Laws Force Siting of New Facilities

The 1986 Superfund Amendments and Reauthorization Act (SARA) requires states to assure the U.S. Environmental Protection Agency that they have adequate capacity to manage all the hazardous wastes generated within their borders over the next 20 years. States that fail to submit acceptable "capacity assurance plans" will be prohibited from receiving Superfund monies for non-emergency cleanups of former hazardous waste sites.

In a process that is similar but not as widely publicized, the siting of radioactive waste facilities has also been ongoing. The Federal Low-Level Radioactive Waste Policy Amendments Act requires each state to take responsibility for disposal of low-level radioactive wastes generated within its borders. Generators in states that fail to meet the federal deadline face increasing disposal surcharges and eventual loss of access to existing facilities.

Geographical Differences in Siting Strategies

There are geographical differences in facility siting strategies. In highly populated areas, there is a trend toward siting smaller facilities that serve a local need. For example, captive hazardous waste treatment and disposal facilities (those located on the property of a generator and sized to meet its needs) have been found to have a better chance of success than large commercial facilities.[4] New Jersey's Ogden Projects, a leading firm in the waste-to-energy business, has given up trying to site oversized merchant plants in response to local opposition. A merchant plant is sized larger than local needs dictate to take advantage of the higher spot market prices. Ogden has found it is easier to site facilities with municipal backing.[5]

In contrast, proposals to develop large facilities to meet regional needs are more commonplace in the arid, sparsely populated areas of the midwest and western United States. Even there, public opposition must be considered.

Siting of Disposal Facilities Linked to Waste Minimization and Recycling

The 1984 Amendments to RCRA mandate hazardous waste minimization, restrict land disposal of certain wastes, and require waste destruction, recycling, and treatment. A growing number of state laws require detailed pollution prevention plans and have set waste reduction goals. In the municipal solid waste arena, issuance of permits for new or expanded landfills and waste-to-energy plants is often linked to implementation of recycling programs and bans on disposal of recyclable or compostable materials.

3.2 WHAT PUBLIC INVOLVEMENT STRATEGIES WORK?

Our experience indicates most successful projects involve the following characteristics:

- Commitment to need for public involvement.

- Demonstrated need for facility/program.

- Political support and leadership.
- Recognition that the "public" is more than vocal opposition groups. Elected officials, business and community leaders, citizens, the media and civic/environmental organizations must be included.
- Credible process and proponents.
- Understanding the local community and tailoring the program to it.
- Willingness to listen and promptly respond to questions and concerns in an open and honest manner.
- Addressing equity issues: monetary and non-monetary compensation.
- Shared decision-making and management authority.
  - Access to information.
  - Local oversight of operations (independent monitoring).
  - Representation on management boards.

Some examples that illustrate these concepts are presented below.

Public Involvement in Development of Regulations Addresses Issues Early in Process

The Commonwealth of Pennsylvania, home to the Three Mile Island nuclear power stations, has laid the groundwork for a private operator to site and develop a low-level radioactive waste disposal facility. A statewide program that recognizes the critical importance of public involvement is underway.

A 19-member Public Advisory Committee (PAC) served in an informal capacity to provide input on the facility development process prior to passage of state enabling legislation. The PAC was made up of statewide organizations representing industry, environmental/civic interests, and local government. Passage of the Commmonwealth's Low-Level Radioactive Waste Disposal Act in 1988 resulted in the formation of a 23-member Low-Level Radioactive Waste Advisory Committee (LLWAC). The LLWAC had two primary functions: review of draft regulations, and participation in the operator selection process.

The LLWAC commented on multiple drafts of the regulations, and many of its suggestions were incorporated. For example, design and siting criteria, host community compensation, and local oversight of operations (including shutdown authority) are addressed. In addition, the use of an above-ground vault for waste disposal, the publicly preferred option, is required.

The LLWAC has taken a very active role in facility operator selection. It participated in the development of the request for proposals for a private operator, and ensured that effective public involvement in the operator's program was a priority evaluation factor. LLWAC members spent considerable time educating themselves, and cosponsored public meetings with the potential operators across the Commonwealth. The Commonwealth recently completed contract negotiations with the selected operator.

This example demonstrates that an advisory committee can effectively participate in development of complex, programmatic elements such as disposal facility siting, licensing and operating regulations. Key concerns of environmental organizations and the public are addressed in the law and regulations, which has enabled the DER to concisely define what type of facility will be built and respond to concerns and questions that are raised. The DER has established itself as a strong and capable regulator that will ensure the safe operation of the facility. Extended involvement of individuals over a period of time has built a broad base of knowledge and facilitated effective participation. Committee members have developed a personal commitment to participating in the process.

A Citizens Advisory Committee with a Clearly Defined Role and Adequate Funding, Can Be Extremely Useful

A private developer, US Ecology, was selected to site and develop the State of California's low-level radioactive waste disposal facility in 1985. Arizona and North and South Dakota will also use the facility. The State of California conducted statewide screening to identify technically suitable areas for further study in 1984. US Ecology followed an open, public process to select the Ward Valley site from these areas. This site is currently undergoing full characterization and licensing. The involvement of an independent citizens advisory committee has been viewed as critical to the success of the program.

An independent Citizens Advisory Committee (CAC) was formed to participate in regional screening, and was funded through a grant to the League of Women Voters (LWV). Workshops were held to obtain input on the relative ratings of 16 technically suitable sites. The role of the CAC was strictly advisory, not decision-making. The state regulatory agency and US Ecology made all the final decisions. CAC input was accommodated when possible. The LWV provided a skilled neutral facilitator. US Ecology and the state developed concise agendas and scheduled meetings at key decision points, rather than on a monthly basis. The role of the LWV was to facilitate the exchange of information--not express personal opinions.

Once US Ecology selected three candidate sites for characterization, a Local Advisory Committee (LAC) was established at each site. The size and composition of each LAC was determined locally. US Ecology ultimately picked the Ward Valley site. Local leaders in Ward Valley supported selection of the site, and no opposition resulted. The excellent technical features of the site have been very important to public acceptance of the facility.

The Ward Valley LAC will have ongoing involvement in review of the license application and environmental impact analysis, and will provide input to both the State of California and US Ecology. It will continue during facility operation.

No compensation package was offered to the local community. The economic development potential associated with the facility was enough incentive. The site is located 22 miles outside of town in the desert. The land is currently owned by the federal government, but will be turned over to the state. Local zoning and population growth/development pressures were not issues at the site.

The lesson learned in this case is that citizen advisory committees can be very valuable but require a considerable commitment of time and staff resources. A successful CAC must have a clearly defined role (e.g., in this case, advisory not decision-making) and be operated under defined ground rules. The scope and timing of input must be clearly defined. An independent facilitator to conduct CAC meetings and maintain focus is highly desirable. Funding must be provided to cover CAC operational costs and independent technical review. Some guidelines on the use of these funds should be provided (e.g., not to pay for litigation) but flexibility must be built in.

Political Support and Leadership Is Essential

The New York State Low-Level Radioactive Waste Siting Commission has been charged with selection of a site and method for disposal of low-level radioactive wastes generated in the state. The state law establishing the Siting Commission and outlining the facility development process was passed in 1986. It included an eminent domain clause.

In December 1988, the Siting Commission announced the selection of 10 candidate areas for further study. Massive public protests resulted, and culminated in the attendance of thousands of people at public meetings across the state. In September 1989, the Siting Commission announced the selection of five potential sites in Allegany and Cortland Counties. Public protests and outcry steadily increased until December 1989, when technical staff attempting site walkovers were turned back by protestors on more than one occasion. In the spring of 1990, a local information office was opened near one of the potential sites. Manure slinging, offerings of dead animals, vandalism, and loud and ongoing demonstrations resulted. Governor Cuomo finally ordered closure of the office.

Opposition groups aggressively lobbied the state legislature and Governor's Office while the Siting Commission maintained a low profile. Eventually, the Governor's Office introduced and helped pass new legislation that modified the siting process and changed the management structure of the Siting Commission. The lesson learned in this case is that following the legally prescribed path does not ensure project success. Elected officials at the local, state and Federal levels react to pressure. Project proponents must provide information and respond to the needs of elected officials at all levels, as well as the public, to ensure that visible support for the program is maintained.

Roles and Responsibilities Must Be Clearly Defined and Publicized

In the case of the Siting Commission, a complex, legal/regulatory process created confusion and stymied decision-making. State law established a complex process with roles for five separate state agencies in the siting, development, and regulation of the facility. No lead agency was defined. Inter-agency coordination and communication were difficult, and the public was confused by the roles of the various agencies and experienced difficulty obtaining information on the overall process. For example, agencies duplicated activities (e.g., public meetings, public information, outreach activities, etc.), believing people would make the distinction between agency roles. Conflicting information was sometimes presented. In addition, decision-making involving multiple agencies was cumbersome, constraining the ability to react to new and constantly changing situations.

The lesson learned in this case is that clearly defined roles, responsibilities and accountability facilitate the exchange of information and responsiveness to public concerns. Regulatory agencies must maintain some distance from facility operators to maintain their credibility and independent oversight role. However, they should also facilitate access to information and response to concerns by all involved parties. Political leadership is critical.

Regulatory Requirement for Public Involvement and Negotiations

To overcome local opposition to new waste disposal facilities, at least six states have enacted laws to override local decisions related to the siting of these facilities. Protection of local interests is typically built in by: (1) establishing technical performance standards and locational criteria to protect the environment and (2) establishing incentives for the developer to negotiate with the community to identify and resolve local concerns.

The State of Wisconsin has established a parallel approval process of facility licensing and negotiations for landfills. The Wisconsin Department of Natural Resources is responsible for establishing the need for the facility, and the technical and environmental regulatory review related to licensing. The applicant must negotiate with local citizens to address social and economic issues related to the design, operation, and closure of the landfill. If an agreement cannot be reached, the State Waste Facilities Siting Board oversees binding arbitration. According to a 1989 study, 103 facilities have been subject to the law. No negotiations were involved in 30 cases. The remaining 73 cases include 26 negotiated agreements, 41 ongoing negotiations, and 5 projects that have been withdrawn. Most successful negotiations have involved some type of monetary compensation.*

Developers appear to prefer the override process more than municipalities. Municipal complaints include the fact that small municipalities are not provided with adequate resources upfront to participate in the process; negotiations need not be completed before facility operation commences; and while most issues are negotiable, only a limited number are arbitrable.

In conclusion, override legislation will not work alone and has some drawbacks. Override legislation must be accompanied by strong negotiating incentives for both sides. Two-way communication to provide information on the facility, and identify and address local concerns, is necessary prior to initiating negotiations.

Local Oversight of Facility Operations

Headlines in February 1990 read "Alaska Pipeline Cedes Power to Watchdogs." To increase credibility, the seven-member oil consortium known as the Alyeska Pipeline Service Company formed and funded a permanent advisory group with unprecedented powers. The 15 citizen members represent Alyeska's pipeline terminal impact area, including voluntary representatives from native and community governments, fishing groups, and environmental groups.

Alyeska's development of the north-south crude oil pipeline in the 1970s and construction of its Valdez terminal were accompanied by public concern and protest, but little public involvement. The fishing and environmental groups established an adversarial position with Alyeska from the beginning. Relationships apparently did not improve during 15 years of operations, gaining Alyeska the reputation for arrogance, disregard for public concerns, and a propensity for litigation on regulatory and public issues. Requests were made for a public role in oversight of operations, but were never granted.

When the *Exxon Valdez* spilled oil into Prince William Sound in 1989, the situation changed. Alyeska, representing the involved oil companies, saw potential for added regulatory constraints and interruption of its terminal operations. It moved quickly to make several major changes in its operations, including an ambitious spill prevention and response program, staff changes, and formation of the Regional Citizens Advisory Committee (RCAC).

Contract terms provide RCAC review authority for the life of the pipeline and its closure period, a requirement for Alyeska to respond in writing as to how it incorporated or disregarded any input, annual funding of at least $2 million, agreement to use binding arbitration in disputes, and access to facilities and data to the same degree provided state and federal regulatory agencies. The RCAC has an executive director and offices and will hire and contract for technical support as needed. It has full authority to spend funding as long as it is not used for litigation and applies to Alyeska's operations. The RCAC will focus on technical review and research on methods for spill prevention and cleanup, with emphasis on prevention. It does not have terminal shut-down authority, but believes it could virtually guarantee shutdown through media, political, and public leverage if necessary.

Alyeska's attitude toward the environment and the public has altered significantly in only one year, and the gain in credibility has been remarkable. The investment in the RCAC and other environmental and public involvement activities was substantial, but has greatly benefitted the industries' operating positions.

Involvement in Facility Management of Increasing Importance

The 1986 Superfund Amendments and Reauthorization Act requires industries to report annually on their multimedia toxics discharges. These "toxic release inventory" data are widely available and have been used by environmental organizations to target industries for demonstrations and action.

A large pulp and paper mill in the Southeastern United States had this experience. The mill is the largest employer in the nearest ten counties, and the local economy is clearly dependent on the mill. Because of this dependence, and the fact that the company was basically a good neighbor, mill managers felt there was little reason to discuss facility risks with the public or participate in community emergency planning efforts, despite urgings of their corporate overseers and trade associations. Their attitude . . . "We follow all regulations, we are the largest employer within 100 miles, and the community needs us. Why should we raise concerns unnecessarily?"

Unfortunately, following the release of toxic release inventory (TRI) data in 1989, the mill was placed high on the state's list of large emitters of hazardous substances. It was subsequently targeted by large environmental groups. A Greenpeace boat floated up the river and orchestrated a widely publicized protest. Television, radio, and newspaper reports kept the story in the news for weeks. While management was not necessarily surprised by Greenpeace's actions, or even the media's, they were stunned by the concern voiced by many local residents. The reaction was so strong that it jolted the company into overhauling its community education/participation program. Mill management is continually taking active steps to ensure open communication with the public on risk and protection of the environment. Fortunately, management's swift and proper action has opened dialogue and has resulted in many positive joint programs, not the least of which is a new joint emergency preparedness program that is beneficial to both the mill and the community.

Several industrial trade associations, including the Chemical Manufacturers Association (CMA) have also developed programs designed to communicate relevant information to the public. CMA's Community Awareness and Emergency Response (CAER) program has two objectives: (1) to openly communicate relevant and useful information and respond to questions and concerns about chemicals used, stored, and manufactured at various facilities, and (2) to protect employees and residents of chemical plant communities by assuring each facility has an effective emergency response program. Participation in the CAER program is a requirement of CMA membership.

More than 1,500 chemical plants in 1,100 communities are part of CAER coordinating groups. These groups are local committees, comprised of representatives of local government, industry, emergency responders, and private citizens, that participate in the development, testing, and modification of local emergency response plans.

Rohm and Haas, a multi-national specialty chemicals company, has taken community involvement one step beyond the CAER program and SARA Title III compliance. Community advisory councils have been set up near 7 plants. These councils meet regularly to hear what the plant has planned and provide feedback on community reaction to those plans. For example, councils are provided with the results of employee health studies, data on air and water emissions, and plans for new manufacturing processes. Rohm and Haas has made a commitment to improve performance in safe management of chemical products. The 1989 annual report states, "Compliance is not enough.

Environmental excellence is sought. It's the right thing to do; it's good business, and the public demands it."

In a recent interview, a government official shared his view that SARA Title III is part of a movement to remove private control of industry and replace it with public control. He noted that some industries are already beginning to put some control of day-to-day operations into the hands of the public. He cited cases where emissions data are gathered by electronic monitoring devices at plants and fed real-time into libraries and communities. The public is asking for automatic plant shutdown, when emissions exceed certain limits, based on real-time data.[7]

4.0 LESSONS LEARNED

Public involvement does not guarantee the universal acceptance of new or operating facilities. However, without public involvement, most controversial projects will not be successful. The alternatives are litigation, delays, and cost overruns.

It is a mistake to assume the legally prescribed path will ensure project success. A community may lack the legal right to approve/disapprove a facility, but it does not lack the power to interfere. Investing time and resources up front may prevent costly delays and litigation down the road.

A failure to address public concerns can have a real impact on public image and the bottom line. The "best" technical solution may not be publicly acceptable. Public values and preferences must be considered and accommodated.

Local input can improve decisions. For example, site-specific natural resource information may not be available in published form. However, life-long residents are likely to know the locations of springs, areas of historical significance, and wildlife habitats.

Public involvement in decision-making has a mixed record of success. In 1987, the National Governors Association (NGA) conducted a study to learn what is required to ensure the successful siting of hazardous waste management facilities.[8] The NGA found no conclusive data to indicate that public input actually promotes successful siting of hazardous waste facilities. However, public participation of some type, usually public hearings or informal meetings with local officials and residents, was usually included. The NGA study did acknowledge that the recent trend of greater public awareness of environmental hazards will make future siting more difficult than it was during the study period, 1980-1986. NGA recommended that states encourage on-site waste management by generators and public participation in the siting of commercial facilities.

Public involvement programs cannot overcome other program deficiencies. Examples of these deficiencies include:

- Process deficiencies: trying to solicit support after the decision is made (decide-announce-defend).

- Timing errors: attempts at involvement before issues are clearly defined or after opposition groups are well established.

- Arrogance: decision-makers' unwillingness to listen or acknowledge public concerns.

- Determination to focus only on technical issues: failure to recognize that the "best" technical solution may not be publicly acceptable because of personal and group values.

- Lack of power-sharing: a true role in decision-making.

- External influences: widely publicized accounts of operating problems at a similar facility, unrelated to a proposed project.

How the public will respond to a given proposal is difficult to predict precisely. Clearly, the response is dependent on a variety of factors, including how the media present issues, how issues are defined in the public debate, and the occurrence of accidents or events outside the control of the issue at hand. Each situation is unique. The appropriate public involvement strategy must be tailored to the regulatory environment, local conditions, past experience, and other factors.

5.0 SOME FINAL THOUGHTS

It is a formidable task to summarize the experiences industries and governmental agencies in the United States have had with siting controversial facilities. Yet certain common threads unite everything that has been discussed. It is clear that the national, and the international, agenda for environmental issues must be clarified and prioritized. Our citizens are asked daily to understand, participate in, and accept a spectrum of environmental decisions and to devote a growing portion of our national resources to solving them. We must develop better tools to help our citizens understand issues and provide input to accomplish this formidable task.

Some possibilities may include:

- Working closely with school systems to reach children and young people early, raising not only their environmental awareness but also their understanding of the tradeoffs, resource allocations, and compromises that are needed. Programs on littering, stream management, and recycling are already effective in many of our schools, but young people must also understand the need for waste treatment and disposal facilities, manufacturing plants, and other controversial but essential facilities.

- Effectively using mass media to provide information and facilitate discussion of these issues. A full range of media outlets, ranging from national-level electronic media to local newspapers, must be included. Standard media interaction campaigns seem to reach only those individuals and groups that advocate positions or would become involved anyway. Innovative and creative media approaches must be developed to communicate a more balanced perspective.

- Simple conversation works wonders. Providing forums and stimuli for discussion of why controversial facilities are needed, how they fit into the overall context of our environmental problem-solving framework, and what public involvement can do to help, must take place at all levels.

Simply going through the motions of public involvement (e.g., obligatory public hearings, public notices) will no longer suffice. Public involvement is not a "do-gooder" activity meant simply to satisfy a vague notion that the public is entitled to participate. Creative, multi-layer, politically savvy programs are needed to complement a larger conscious-raising ethic that considers environmental issues as a group, not as single problems. Political leadership, crucial to individual projects, is also crucial to changing how we address issues such as siting controversial facilities. That "how" is changing, and as project proponents and public involvement practitioners, we need to work harder to find new and better ways to define not only society's environmental objectives, but our project and program objectives as well.

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GOOSE BAY MOBILE PCB INCINERATION PROJECT

A Paper Presented to the
Twelfth Canadian Waste Management Conference
St. John's, Newfoundland, October 3 - 5, 1990

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INTRODUCTION

The purpose of this paper is to outline the recent experience of Proctor & Redfern in siting and monitoring a mobile PCB Destruction Facility at Goose Bay, Labrador for the Department of National Defence. The paper is divided into two parts: the first provides a description of the background to the project and a chronology of events; part two concentrates on the measures taken to ensure meaningful public consultation. The paper concludes by drawing lessons from the experience for the benefit of future facility planning.

BACKGROUND

Goose Bay, Labrador is located approximately 200 kilometres inland from the Labrador Coast, on the shores of Lake Melville which connects the Churchill River to the Atlantic Ocean. It is the site of one of Canada's largest military facilities, Canadian Forces Base Goose Bay (CFB Goose Bay). Until recently, it was the site for the destruction of approximately 40 percent of the Federal Government's PCBs.

The PCB material incinerated at Goose Bay was mainly contaminated soil that originated from the cleanup of transformer spills at abandoned radar sites in Labrador during the 1970s and 1980s. The spill sites had been cleaned-up through the remediation efforts of the Department of National Defence (DND), Environment Canada (EC) and the Newfoundland Department of Environment and

Lands (NDEL). This material was stored in drums and vaults in three locations: two on the Labrador coast, at Saglek and Cartwright, and in various sites in and around CFB Goose Bay. In all, there was approximately 3,500 tonnes of PCB-contaminated material, mainly soil but also transformer carcasses, mineral oil and askarel.

By 1986, DND had realized that the storage of PCBs was not the best long term strategy for the management of their PCBs. Consequently, DND commissioned a study to evaluate PCB disposal options and establish a Steering Committee of representatives from DND, EC, NDEL and the Town of Happy Valley - Goose Bay. The Steering Committee's mandate was to oversee the progress associated with the evaluation of disposal options. The Committee also initiated the public consultation process.

The report on the disposal options evaluation, completed in 1987, recommended the destruction of the PCB-contaminated materials by a mobile high temperature incineration facility.

The Saint Basile-le-Grand PCB warehouse fire of August 1988 highlighted the public fears of long term PCB storage and prompted the Federal Minister of Environment to commit to the destruction of Federally-owned PCBs. Because preliminary work had been completed, Goose Bay was chosen to be the first project in this program. With this commitment in place, DND proceeded to implement the recommendations of the 1987 study.

In November 1988 Proctor & Redfern Limited (P&R) was retained by DND. Our first task was to establish a detailed inventory of the PCBs in storage in Goose Bay, Saglek and Cartwright. Concurrently, DND and P&R worked to prepare an Initial Environmental Evaluation (IEE) in accordance with the Federal Environmental Assessment and Review Process (EARP)[1]. There were three key components to the IEE:

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1. The Proctor & Redfern Group, Initial Environmental Evaluation of Mobile Incineration of PCB Wastes at CFB Goose Bay, Labrador. Prepared for the Department of National Defence, March 16, 1989.

- Site Selection. The study evaluated nine possible sites; it recommended a site to the west of the CFB Goose Bay airfield.

- Health Hazard Assessment[2]. This study assessed the health risks to workers and the local communities from normal incineration and transportation operations and from various accident scenarios.

- Environmental and Community Health Protection Plan[3]. This report outlined the mitigation and monitoring measures to be undertaken to protect health, safety and the environment.

The completion and approval of the IEE in the spring of 1989 was followed by the preparation of specifications by P&R for the incineration contract and the competitive tendering of this contract by Supply and Services Canada. O.H. Materials of Canada (OHM) was awarded the incineration contract in August 1989. OHM's proposal was based on the use of a Mobile Infrared Incinerator.

The only reliable transportation route into Goose Bay for heavy equipment is by sea but, due to sea ice conditions, this route is only open from mid June to late October. This meant that all PCBs, equipment and materials had to be moved into Goose Bay by O.H. Materials within two months. To their credit, OHM succeeded in meeting the demands of this schedule. The PCB materials from Saglek and Cartwright were barged to Goose Bay, arriving in late September. The OHM incinerator and associated equipment arrived in mid October.

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2. CanTox Inc. Health Hazard Evaluation of Emissions Resulting from the Destruction of PCBs by Incineration, CFB Goose Bay. Prepared for Proctor & Redfern Ltd., March 14, 1989.

3. The Proctor and Redfern Group. Goose Bay PCB Destruction Program Environmental and Community Health Protection Plan. Prepared for the Department of National Defence, March, 1989.

Meanwhile on-site and in the surrounding area P&R was performing the pre-operations environmental monitoring of air, water and soil. By the end of October the site which was located on the western edge of CFB Goose Bay about 7 km from the Town of Happy Valley - Goose Bay was taking shape with the erection of the massive greenhouse like structure which would house the incinerator. Assembly of the incinerator was completed in early December; component checks and system testing with clean soil were completed on time for Christmas 1989.

In January 1990, final adjustments were made and the first set of stack tests took place to verify the incinerator would meet the Federal and Newfoundland Mobile PCB Regulations. The tests were successful and OHM proceeded with incineration.

On February 1, 1990, a power failure occurred at the site. Although the system was equipped with emergency diesels and other standby systems, the backup incinerator exhaust system failed to operate correctly; as a result negative pressure within the combustion chamber was lost and smoke and gases contaminated with PCBs escaped from the primary chamber of the incinerator into the building. DND and the regulators ordered an immediate shutdown of incinerator operations until the cause of the problem and the extent of environmental damage could be determined.

P&R was requested to set up a special task force to investigate the incident for DND. P&R's report attributed the cause of the incident to the failure of a critical damper in the emergency exhaust system to open when a spring loaded piston became jammed[4]. The report also concluded that although PCBs, dioxins and furans escaped the primary chamber, the rapid response of OHM operating personnel ensured that there was no adverse impact; the quantities released were small and these were contained within the building. The report concurred with a design change suggested by OHM to improve the reliability of the backup exhaust system.

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[4] The Proctor & Redfern Group. PCB Release Study. Prepared for the Department of National Defence, February 28, 1990.

In mid March 1990, once all recommendations had been implemented, OHM was given authority to resume incineration. Incineration continued until April 11th when, during another power failure, a second malfunction of the back up system occurred. This time the backup water supply, which cools the hot exhaust gases from the secondary chamber, was mistakenly throttled back. The hot gases entering the fibreglass air pollution control equipment caused considerable damage to the system however there was no detectable escape of contaminants.

Again the system was shut down while repairs were made and an investigation was conducted. Following repairs and further system modifications, OHM resumed incineration on May 28th and completed the task in early August 1990. Demobilization and site closure activities took place until early September 1990.

Throughout the project, P&R and regulators conducted monitoring of ash, water and ambient air to ensure compliance with regulations and for comparison with samples taken before and after incineration. On three occasions, stack testing was also conducted to confirm that these emissions also met the regulations.

THE PUBLIC CONSULTATION PROCESS

The Public Consultation Process at Goose Bay evolved from the need to gain public acceptance and deal with the concerns of stakeholder groups. This need was identified from the lessons learned from the previous experience of siting hazardous materials facilities in Canada and elsewhere. It also came from a growing realization by all governments that the public wanted direct input into decisions that could affect their health and environment.

In 1986 and 1987, public meetings were held in Goose Bay to inform the public of the PCB storage situation and review the results of preliminary studies. Although concern was expressed at this stage, the 1988 Federal announcement that Goose Bay would be the site of an accelerated federal program to destroy federally owned PCBs galvanized the public of Happy Valley - Goose Bay and surrounding areas. For many, this was a decision being imposed on them from Ottawa. At a public meeting held in November 1988, it became apparent that the public would not be satisfied with just information. It was also clear that mistrust of the military, government, consultants and even the regulators was widespread.

Following this meeting, a communications strategy was developed that accentuated contact between the DND Project Manager, technical experts provided by P&R, the media and small groups within the community. The framework provided by the federal EARP process offered the opportunity to seek public input in stating concerns to be investigated. It also provided a forum for contact which helped to build trust. The process at this stage included discussions with educators, public service organizations, hospital staff and others. Proctor & Redfern provided a toxicologist (CanTox Inc.) to help explain the nature of risks associated with PCBs however the emphasis was placed on listening to concerns and building relationships. A concentrated effort was made to develop a relationship with local media by providing background information and responding to requests for interviews. Finally, in February 1989 P&R arranged a visit to an operating PCB destruction facility in Alaska for two Town Councillors and two members of the public selected at an earlier public meeting.

In April 1989, the results of the IEE were released to the public in an Open House format. Public comment was sought and a commitment was made to consider public opinion prior to making a final decision. Although some opposition remained, the assessment by reliable sources within the community was that there was sufficient support for the project to proceed. At this stage, consultations were held with local politicians to ensure they understood the situation and were prepared to support the incineration program. In June 1989, the Steering Committee adopted the recommendations of the IEE and authorized the project to proceed.

During the summer of 1989, the contractor selection process was completed with little attention from the media or the public. However in mid July several concerned citizens began voicing concerns about the project, particularly regarding the potential importation of PCBs from Saint Basile-le-Grand that the Quebec government had sought to ship to Great Britain. In August, DND announced the award of the destruction contract and brought the concern to a head. Not satisfied with assurances from DND that only PCBs originating in Labrador would be involved, a group of concerned citizens sought and succeeded in obtaining a commitment by the Minister of Environment to that effect. With this success, the group turned its attention to the incineration plan.

DND recognized that dealing with a specific representative community group had many advantages. Its members would likely be better informed than the public at large, their presence would focus and filter concerns, public participation in decision-making would be easier to manage and a certain level of trust might develop between individuals. In mid August, DND held the first of many meetings with the Concerned Citizens Group on PCBs. One of the first tasks was to seek the Group's opinion on the format of a public meeting to introduce the incineration contractor. Further meetings were held to review and update the Environmental Protection Plan and to prepare joint information releases to the public. Although vocal opposition remained, a consensus was being built around the positions being taken by the Citizens Group.

While consultation was beginning with the local Concerned Citizens Group, the Labrador Inuit Association begin voicing strong concerns about the risks associated with the transportation of PCBs by barge from Saglek and Cartwright. Several meetings were held and eventually a compromise was reached that committed DND to added safety precautions beyond the requirements of the Transportation of Dangerous Goods Act. The agreement was widely reported and provided valuable momentum to public consultation efforts at a critical stage.

As the Citizens Group became more informed, the number of concerns was dramatically reduced however those that remained were difficult to resolve. An example of this was the demand by the Citizens Group that the incinerator be shut down following the initial stack testing while the laboratory analysis was completed. We argued that the unit had already undergone testing and that the proposed stack test was only being done to confirm compliance; waiting for lab results would have cost DND approximately $400 thousand in standby costs. The Citizens Group argued that the fact that the test was required indicated the compliance was not assured. Eventually another compromise agreement was reached that committed DND to accelerate the analysis of the first test while the tests remaining were still underway. This agreement cemented a growing trust and established a strong working relationship.

Meetings with the Citizens Group continued throughout the Fall of 1989 and another Open House was held once the incinerator had been assembled on the site. Impressed by the magnitude and complexity of the incinerator, the public seemed very supportive of the project.

Public support and the trust that had been built up with the Citizens Group were sorely tested during the February 1st incident and again in April. In both cases, the Citizens Group was informed immediately, as were the media. Accurate information was passed on as soon as it became available. From the start, DND resisted the temptation to downplay the incidents and further public meetings were held in each case. Once all the facts were available, the options were discussed, first with the Citizens Group and then with the general public. The decision to resume operation in each case was made with the agreement of the Town Council and the Citizens Group. Indeed, the Mayor and the Citizens Group responded to the incidents in a manner that indicated that the incidents were a shared challenge. Following the successful completion of the project, the Minister of National Defence recognized the contribution of the Town, the Labrador Inuit Association and the Citizens Group through the presentation of letters of appreciation.

CONCLUSION

Media hysteria and public fears about hazardous wastes can be potent opponents to reasoned dialogue. A dialogue with affected communities and stakeholder groups is absolutely essential. Based on the experience in Goose Bay, there are three ingredients for establishing this dialogue: information, trust and meaningful consultation.

Information is essential to the process, however proponents must be patient in communicating it. A large number of contacts with small groups is preferred. Constant contact with the media is also essential.

One of the most important pieces of information we have for the public is that there are no perfect solutions to most environmental problems. We cannot tell people at a public meeting that the best available mobile PCB incineration technology will not produce PCBs, dioxins or furans - it does - but it also destroys at least 99.9999% of the contaminant. And when we compare this to the release of PCBs by continued storage and handling accidents the choice is clear.

Similarly we cannot tell the public that a system is 100% fail safe. Exploding space shuttles and nuclear power plant melt downs are just two of the relatively recent examples the public has of engineering's ability to provide fail safe systems.

Building trust is less straightforward and cannot be achieved by any specific formula. It also requires time and an understanding of the history and customs of the community.

To a large extent trust will be based on the community's understanding that all the information concerning the project has been openly and honestly presented and that all possible adverse effects have been fully considered.

Meaningful consultation requires an acceptance that additional funds may have to be expended reproving scientifically accepted positions or providing for the possible mitigation of very low probability events. It also means that once the proponent has expended a great deal of time, effort and money to provide all the information, risk studies, mitigation measures and contingency plans that the community members have a responsibility to base their support of the project on the facts and not on emotional issues.

In the final analysis, proponents should also recognize that unanimity is unlikely and that some opposition must be expected, even in the best of cases.

Together We Made It Happen

by

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To begin my presentation I would like to commend Environment Canada for having the initiative to invite me, the chairperson of the concerned citizen's committee, to this National Hazardous Waste Conference. I believe the destruction of hazardous waste is everyone's problem. Therefore, involving "citizens", the core of any community, can only be a progressive first step in finding a solution to this country's hazardous waste problem. "Not in my backyard" has been a slogan of this country for too long. Together we have helped create waste products that are a threat to our environment, so together we must work towards an agreeable solution for their destruction. Environment Canada and the Department of National Defense have initiated progressive steps in this direction: Environment Canada, for inviting me to speak from the citizen's perspective; the Department of National Defense (D.N.D.), for taking seriously the citizen's committee's role in this project and working hard to make it happen.

It is this process, from the committee's perspective, that I wish to address. Our committee was the second citizen's committee. The first committee was formed in the early stages fo the process and folded around the time the contract was signed. Then in early August, the local Women's Centre sponsored a public meeting to promote awareness and stimulate community involvement. It was from this meeting that the second citizen's committee was formed, and became a working committee of six people. Our first priority was to see if anyone from the first committee was interested in still being on a citizen's committee, and one person came forward. Equally important was deciding on a mandate. We had to decide if we would oppose the incinerator or monitor the process. Needless to say, we chose the latter, basing our decision on our belief that we could not expect anyone else to take our PCBs. For us this process raised an ethical question. Did we have the knowledge to appear in public in favour of or against something that could potentially effect our community? It was an awesome responsibility and one we did not take lightly. With this in mind, we began the momentous task of trying to educate ourselves about PCBs and the Infrared Incineration System. Despite being unsure of our knowledge, we began the process of working with D.N.D., O.H.M. (the contractor), Environment Canada and the Provincial Environmental Department. Struggling to understand their technical terminology we worked hard to impress upon them the importance of simplifying their information for the public. We advised when and where to hold public meetings ensuring that they would not conflict with other ongoing community agendas. The language issue proved to be very important throughout the process. We spent tedious meetings with D.N.D. and Proctor and Redfern going over terminology on questions and answers to be used for public information in the local media. Everyone worked hard to achieve this goal. I feel I can say, without hesitation, we did achieve this to everyone's satisfaction. Throughout the process the committee kept a high profile, thereby receiving many questions and concerns from citizens in the community. As a committee of the community, we took the questions and concerns to each meeting, then ensured the answers went back to the community. As well as advising Proctor and Redfern of the people's concerns, we also endeavored to bring them information about local conditions that could have affected the project. Examples of such conditions were: prevailing winds, water breaks in winter, power outages, and the inability to get some supplies in local stores, especially in winter. Then, of course, we had our contentious issues. We lobbied government, for an assurance that our community would burn only the PCBs initially announced at the beginning of the project. With news of Baie Comeau's PCBs floating around it posed a real threat to our community. The guarantee we attained from the Environment Minister, The Honourable Lucien Bouchard, did much to alleviate some fears in our community; that we would become a permanent PCB incineration site, we had citizens willing to accept responsibility of their own waste, but not waste from outside Labrador.

Next was the issue of the compliance test -- a government legislated test that would be conducted by Environment Canada. The test was to check the incinerator's emissions for: PCBs, furans, dioxins, metals and particulates. During and after this test, the incinerator would continue to burn PCBs while waiting for the results. The committee agreed with the legislation to test, but disagreed with not waiting for the results. Following this disagreement the committee lobbied government and obtained the following agreement: to have the test results speeded up and to stop the burn if the test results were not back in five days. Despite the fact that this agreement added to the financial cost of this project the committee felt it was more positive than negative for the project. It was the turning point in the entire process. Firstly because it showed the community that the committee was being listened to and respected by the powers that be; secondly it established a trust and respect between the committee and D.N.D. This proved to be essential, especially during the accidents that followed. The accidents took up numerous hours in meetings, reading over reports, finding a consultant when we had no funding base, and, of course, having to deal with the media. When it came time to decide whether to agree with a restart of the incinerator, the committee was once again aware of the awesome community responsibility.

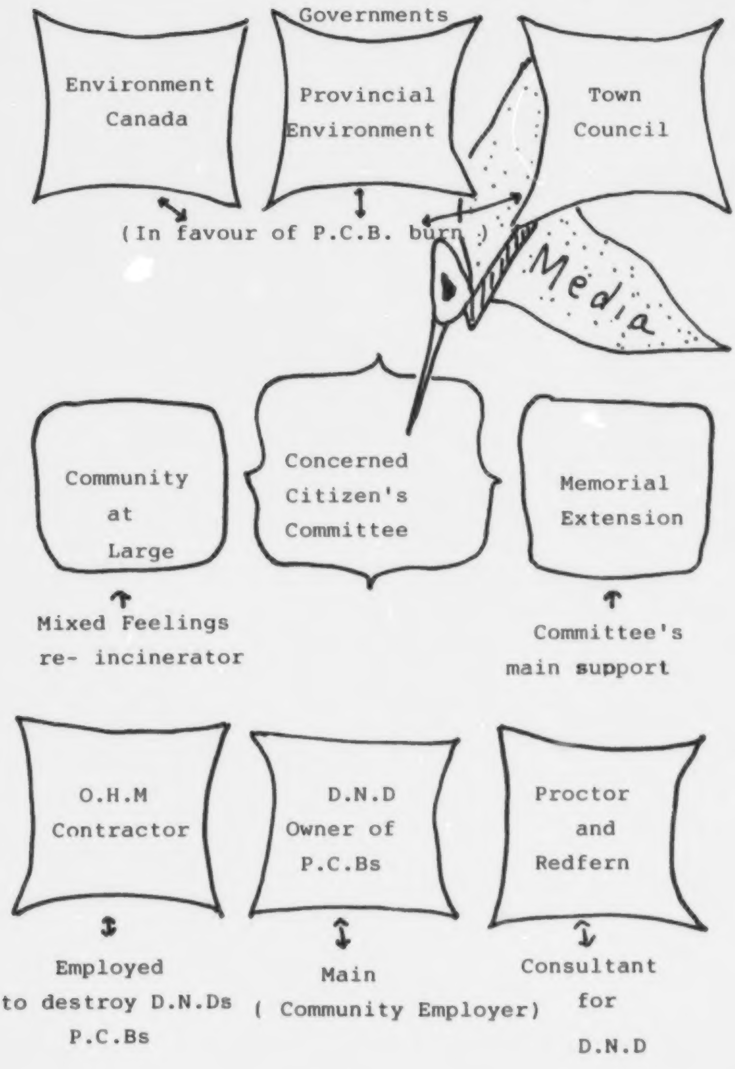
The committee could not have taken on this responsibility without the positive conditions and support which we had. Our greatest support came from Memorial University Extension in our community. Upon the approval of Laura Jackson, their Program Developer, they provided us with moral support, a meeting place, some long distance calls, some secretarial help, and our own consultant, a biochemist and member of their faculty. This support also included airfare for the consultant during the first incinerator accident and telephone advise before and after. The contact people, with whom we worked, were very personable and patient. They tried at all times to maintain a good working relationship with us. The committee itself was a diverse team. Each member contributed something of value, and everyone was willing to share the workload. Members were loyal about attending meetings, despite heavy work related and personal commitments. One member was faced with the additional difficulties of travelling from her neighboring community.

For clarification purposes I have included three diagrams in the appendix. I will use them to briefly explain the interrelationship and structure from which the committee worked.

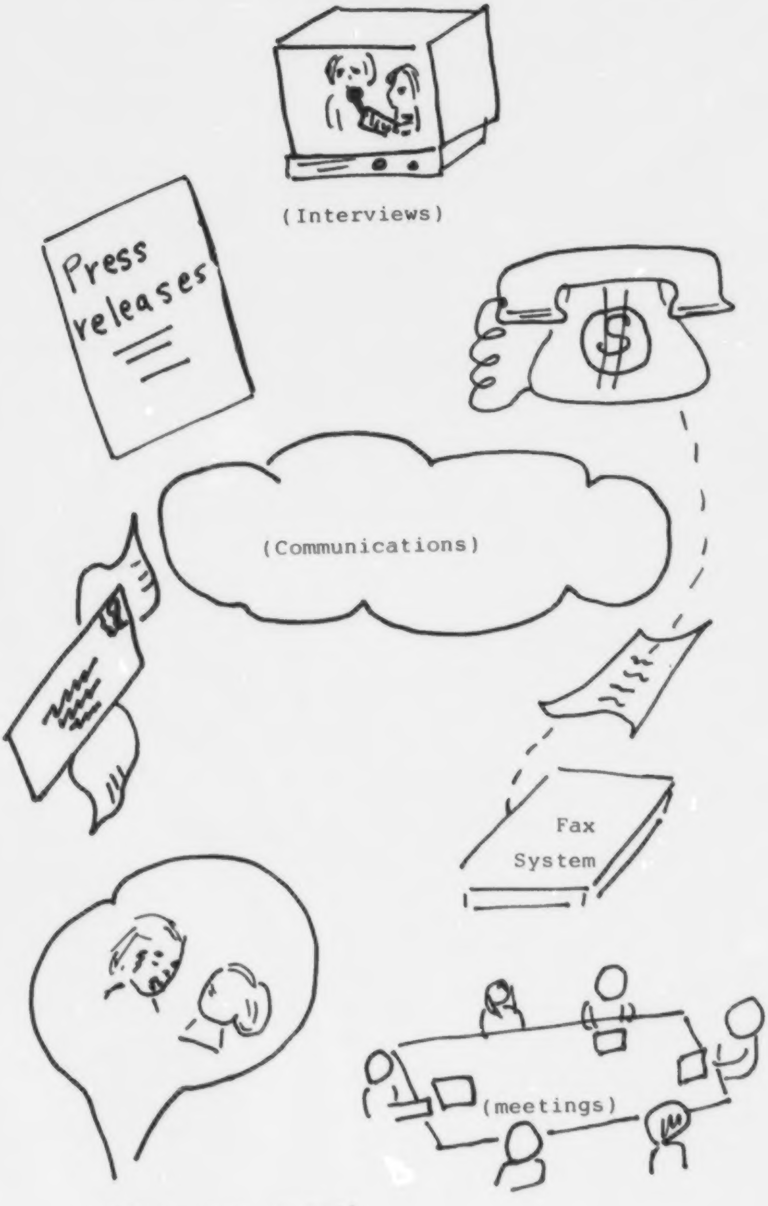
In summarization of this past year, the citizen's committee's work, and the role it played in the process: I can say on behalf of the committee it was worth the effort and we did make a difference. At the conclusion of this project we felt very good about the whole process. The process had taken us through some difficult times, that proved to be challenging and exciting, but ultimately leaving us with a wealth of knowledge.

It is with this knowledge that the committee strongly recommends: that a working relationship is essential between local citizens and all future hazardous waste destruction projects in Canada; for mutual respect, educational respect on both sides and sensitivity to the local sociopolitical environment.

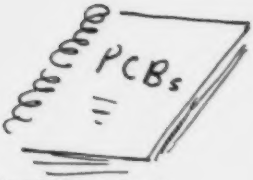
Appendix
A
Concerned Citizen's Committee's Interrelationships


Governments
Environment Canada
Provincial Environment
Town Council
(In favour of P.C.B. burn)
Media
Community at Large
Mixed Feelings re- incinerator
Concerned Citizen's Committee
Memorial Extension
Committee's main support
O.H.M Contractor
Employed to destroy D.N.Ds P.C.Bs
D.N.D Owner of P.C.Bs
Main (Community Employer)
Proctor and Redfern
Consultant for D.N.D

Appendix B

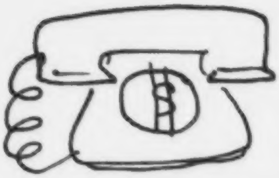

(Interviews)
Press releases
(Communications)
Fax System
(meetings)
(Talking one on one)

Appendix
C

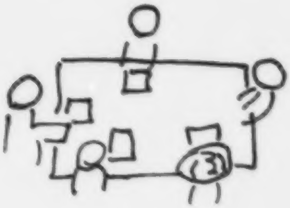


Reading P.C.B.
project manuels

Educating
Ourselves



Talking to consultants,
and other communities.



Chemistry Lesson

Twelfth Canadian Waste Management Conference

THE FEDERAL PCB DESTRUCTION PROGRAM - AN APPROACH TO THE SITING OF MOBILE PCB INCINERATORS IN CANADA

by Stephanie Hunt
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Introduction

The PCB issue in Canada has come to represent a microcosm of the overall hazardous waste problem in this country. There are, however, two sides to the PCB story: the present high level of public concern about these chemicals, and their past benefits to our modern society.

PCBs were first synthesized in 1929 and the benefits that society has gained from them in the following six decades have been enormous. While not widely appreciated by the general public, PCBs have served our needs in a variety of products. Their uses have ranged from dielectric fluids in electrical transformers and capacitors; heat transfer fluids; extenders and plasticizers in sealants, floor coverings, and lipsticks; to additives in carbon paper and printing inks.

This chemical has focused all the fears that the general public has about toxic chemicals. These fears are based upon the perceived acute toxicity of PCBs, which unfortunately, has been largely exaggerated. In the past decade in Canada, PCB incidents have been unprecedented flashpoints for media and public sentiments.

As many of you are no doubt aware, the major environmental concern is that PCBs are very persistent and, as a result of inappropriate past disposal practices and accidents, they have become very widely dispersed around the world. PCBs have entered the food chain and have bio-accumulated as they pass up the chain into the human diet. The trace amounts now found present in Canadians, although not likely to cause adverse health effects, do offer cause for concern should they continue to increase.

The PCB Solution

The end result of the reactions to, and the debate about PCBs, has been an increasing consensus that the solution to the existence of PCBs is their destruction by incineration, preferably, somewhere relatively close to the storage site where they are located. The federal government believes this is preferable to long-term storage and to long-distance transportation.

Although I believe the general public is increasingly in favour of incineration as the solution to the existence of PCBs, most people do not want this to occur near where they live. --Thus, we must learn to address the "NIMBY response".

Background

My presentation today will outline the approach that Environment Canada is taking in coming to terms with this problem, and in implementing a key part of the Federal PCB Destruction Program, that is the siting of mobile PCB destruction facilities, in various regions of Canada.

First, some background information is required to set the stage.

Since 1985, the focal point for formulating a coordinated Canadian effort to deal with PCBs has been the Canadian Council of Ministers of the Environment (CCME). The need for a national approach has become very evident following the leak of PCBs from a transport truck need Kenora, Ontario in 1985. The urgency increased in September 1988 when an arsonist set fire to a PCB storage site at St-Basile-Le-Grand, Québec.

Federal PCB Destruction Program - Original Commitments

To complement the overall national program announced under CCME, in September of 1988, the Federal PCB Destruction Program was announced by Environment Canada. The principal elements of the program reflected the goals set out by Canada's environment ministers, and included the following commitments:

- $6M to be allocated to the Goose Bay PCB Incineration Project, a project which would destroy approximately 40% of the overall federal PCB waste inventory;

- $15M to be allocated to lease a second PCB incinerator to destroy the remaining federal PCB inventory;

- measures to decontaminate low-level PCB-contaminated mineral oil in the federal inventory;

- mobile PCB treatment and destruction regulations to be developed under the Canadian Environmental Protection Act (CEPA); and

- a report to be prepared by the Canadian Environmental Advisory Council (CEAC) on the siting of a transportable PCB incinerator on federal lands.

Over the ensuing year, work by the Department of National Defence began on the Goose Bay incineration project, and Environment Canada began its work on trying to find a site for the second incinerator to be located in central Canada.

CEAC Report Highlights NIMBY Response

In June of 1989, however, CEAC's Report entitled "PCBs: A Burning Issue" was published. This Report supported Environment Canada's own findings regarding the need for full public consultation and participation in the decision-making process for siting mobile PCB destruction facilities.

The central thesis of the CEAC Report was that the siting of hazardous waste destruction facilities is primarily a social process, not a technological one, and that it encompasses health, safety and environmental concerns. This report effectively highlighted the need to overcome the NIMBY response, when undertaking to site even a mobile facility to treat hazardous wastes. The federal government has now come to recognize that the issue of hazardous waste treatment - whether PCBs or not - is not just a matter of technical choice, but also one of public choice.

Enhanced Federal PCB Destruction Program - 1989

In October 1989, the federal Environment Minister announced an enhanced Federal PCB Destruction Program that takes into account the findings of the CEAC report. Instead of siting one transportable incinerator, the new program is aimed at siting federally-sponsored, mobile PCB incinerators to regions across Canada, where the volumes of wastes warrant this.

The siting process is to involve the full cooperation and participation of provincial and private sectors, as well as the communities involved. As the national PCB inventory shows that PCBs are stored in relatively small volumes, at approximately 3,000 sites scattered across the country, this approach also has the benefit of minimizing the amount of transportation required to collect PCB wastes for destruction at one central site. Furthermore, there is the added advantage that, once the task is complete, usually no more than several months, the incinerator moves out of the community and on to another site.

Atlantic MOU

I am very pleased to be here in St. John's to present this paper, as we are proceeding to implement our program in Atlantic Canada, as part of a cooperative project with the four Atlantic provincial environment departments. In August of this year, the federal Minister of the Environment and his four Atlantic counterparts signed a "Memorandum of Understanding Concerning the Siting of a Mobile PCB Incineration Unit in Atlantic Canada". The goal is to develop and implement a plan to destroy the high level PCB wastes in Canada's Atlantic provinces. It is hoped that a site can be found and this project completed within three to four years. When the MOU was signed, all Ministers committed that "a process of full and open public consultation will be followed in order to select a temporary site for the mobile incinerator". As a key component of the Federal PCB Destruction Program, all Ministers confirmed that the public consultation for the project would be conducted in accordance with the two relevant principles of the four major principles for siting federally-sponsored mobile or transportable incinerator projects, which are:

"self-selection of communities", and "community veto". All five involved jurisdictions are strongly committed to follow state-of-the-art public consultation procedures in order to ensure local community public acceptance and agreement regarding the final location of the incinerator.

This project will pose both unique and traditional challenges. Never before have four provinces agreed to work together to select a site for locating a temporary mobile PCB incinerator in their region that will destroy all of the high-level PCB wastes from all four of the provinces. The siting and public consultation procedures will therefore be different in some ways from those employed regarding the use of a transportable PCB incinerator at a Department of National Defence base in Goose Bay, Labrador; and regarding the construction and operation of a permanent hazardous waste destruction facility in Swan Hills, Alberta. Accordingly, one will not be able to simply replicate public communications and public consultation processes and products employed elsewhere. Instead it will be necessary to craft some new ways of going about this project.

It is very difficult to state categorically how the citizens and the media of four quite different provinces, each of which in turn has numerous distinctly varied sub-areas, might collectively feel and think about the various issues related to PCBs.

A very crude indication, however, can be gleaned from a winter 1989 national omnibus public opinion survey conducted by International Environmental Monitor Ltd. of Toronto. That survey contained 16 questions about PCB destruction issues, and it contacted a representative number of people from each of the four Atlantic provinces.

The Atlantic region responses to the key questions were as follows:

- 10% said it was "definitely possible", and 41% said it was "somewhat possible", to safely store PCBs. 18% said it was "likely not possible" and 23% said it was "definitely not possible".

- 11% said it was "definitely possible", and 37% said it was "somewhat possible", to safely transport PCBs. 25% said it was "likely not possible", and 20% said it was "definitely not possible".

- 24% said that they believe that incineration technology currently exists to safely destroy PCBs, 53% said that they believed that such technology does not yet exist, and 21% did not know.

- 55% said that, regarding PCBs now being stored in communities, that we should destroy them now using the best available technology, and 34% said we should store them until better technology is available.

On a comparative regional basis, the 55% figure was quite significant. The only two regions higher were Quebec at 69% (where it is very understandable that after the St. Basile PCB warehouse fire that people would select incineration over storage), and Saskatchewan at 61%.

- Given a choice, 29% said they would be more concerned about living near a mobile PCB incinerator which would operate for a few months, and 50% said they would be more concerned about living near a storage facility for a number of years.

- 12% said they would be "very willing", and 30% said they would be "somewhat willing" to accept having a mobile incinerator located in their community for a 3 month period to destroy PCBs currently stored in their community (a total of 42%).

  23% said they would "not be very willing" to do so, and 26% said they would be "not at all willing" to do so (a total of 48%).

Siting of Mobile Incinerators

In Atlantic Canada and in other regions across the country, the bottom line of this siting process is the full participation and cooperation of the communities involved, and the provincial and private sectors. The rationale is that communities having significant volumes of stored PCBs have four options to consider:

1) They could continue storing the PCB waste where they are, knowing the facility meets national standards, until a permanent destruction facility is available in their province.

2) They might consider building larger central storage facilities, until permanent destruction facility is available elsewhere.

3) If a cement kiln is operating near their community, they could arrange to have their PCBs safely destroyed there.

4) They could bring in a mobile PCB incinerator for a few months to safely destroy their waste once and for all.

- Which will they choose? We are counting on many Canadians choosing option 4. As Nova Scotia Environment Minister John Leefe put it after the August 21 signing of the Atlantic MOU, "We must understand and accept our responsibility as citizens of Canada and citizens of the world, that we have to deal with this in our own way and clean up our own houses." It seems to me (and most experts agree) that we are inviting new incidents such as the Saint-Basile-le-Grand fire, by allowing these PCB wastes to languish in temporary storage facilities for very much longer -- facilities that often were not designed for long-term use. It also does not make sense to spend millions of dollars building new storage facilities instead of working towards eliminating the problem all together.

Compared with the environmental and health risks associated with the current storage situation, we believe incineration is less risky and safer.

I want to emphasize that participation in the Program is voluntary. We are not targeting particular communities to locate incinerators. We are simply offering communities this option and are willing to assist them in exploring all their options. For example, the approach which is already underway in the City of London, Ontario may be considered a generic approach.

London's Operation LEAP

Last April, I received a telephone call from Mr. Terry Clifford, M.P. for London-Middlesex. As a federal Member of Parliament, he was familiar with the Federal PCB Destruction Program, and moreover, as an environmental advocate himself, he was eager to learn about the potential for this program assisting his community.

London is no stranger to the PCB problem and a high level of public awareness about PCBs made the citizens open to the idea of considering new solutions. Mr. Clifford was instrumental as he helped Environment Canada begin a dialogue with a variety of local environmental groups, electrical utility representatives, politicians, municipal and provincial officials. Eventually, the key players formed a coalition of citizens now known as "Operation Londoners for the Elimination of All PCBs" (Operation LEAP).

In May 1990, the LEAP group became very interested in portable PCB incineration technologies and approached Environment Canada for information and assistance. Subsequent to this, arrangements were made for the group to visit both the transportable incinerator operating in Goose Bay, Labrador and the Vesta mobile incinerator being tested at Swan Hills, Alberta. Environment Canada funded both trips. In May, all political representatives and the utility officials voluntarily withdrew from the group because of potential conflict of interest situations, and to allow the citizens and community representatives to proceed independently, which it did. In June, the LEAP group formally asked the Minister of the Environment to assist them and provide them with funds to facilitate the destruction of London's PCBs. The Minister of the Environment responded with a letter which committed Environment Canada to provide technical and administrative assistance, to fund both the community involvement program and the technology selection and siting program and to contract with the selected PCB destruction firm.

Since then, Environment Canada has contracted with a technical specialist on a part time basis to provide the LEAP group with technical, communications and administrative assistance.

The LEAP group is hoping to have a solution implemented by 1992 or sooner, however, actual timing will depend on a wide variety of factors including the environmental assessment process, the availability of the selected technology, the ability of PCB owners to meet the timetables set and the rate of destruction of the selected technology.

The "Social Contract"

Both the Atlantic Canada and the London projects will require a deep level of commitment to cooperation between government and the public. Just as we are committed to public consultation, the public must be committed to helping us find a solution to the PCB problem.

The cooperative ventures in Atlantic Canada and London should be exemplary, illustrating how governments and the public can work together to implement solutions. Both projects have at their core a commitment to open and flexible public consultation and participation. Different regional approaches to suit specific needs will need to be developed in both situations; similarly, new, innovative ways of dealing with unforeseen obstacles will need to be developed as the Federal PCB Destruction Program becomes involved in different provinces and communities.

It will not be an easy way forward, and the question of public choice when applied to PCBs, is one of the most difficult, the most challenging we at Environment Canada have had to face.

First, because the choice is made at a community, not a national level, and secondly, because the question falls outside our traditional areas of operation. Environment Canada, as most of you know, is largely a natural science-based organization. Our concerns relate to protecting the environment and human health. Our expertise extends into technical research and analysis of environmental risks. While these skills may come into play in defining the public choice there is certainly other information and experience that must be brought to the table.

It is challenging us to move away from our traditional modus operandi. To date we have held back a bit, partly due to the challenging nature of the PCB inventory in Canada, partly due to the precedents our actions set for addressing other waste management problems. Partly in recognition of the experience of others - in Canada and elsewhere - in siting hazardous waste facilities.

In moving forward with the Federal PCB Destruction Program, we are very aware of the lessons learned from past siting efforts around North America. We know that we need a flexible process that will allow as much community control as possible, including the ability to opt out of the process at any time.

Federal Mobile PCB Treatment Regulations

In order to make this enhanced program possible, a number of key steps were necessary to lay the foundation. First, the Federal Mobile PCB Treatment and Destruction Regulations, which are equivalent to the most stringent international standards, were developed under CEPA. This means that there is a federal regulatory framework in place for mobile PCB incinerators and treatment systems. The provinces are following suit, and Newfoundland and Ontario already have similar regulations in place for mobile systems.

PCB Waste Export Regulations

A ban on the overseas export of PCB waste was also put in place in July of this year. The PCB Waste Export Regulations have been introduced in recognition that Canada is committed to managing its own PCB waste, by seeking a domestic solution. In essence, the Regulations prohibit overseas export, meaning that owners of PCB waste will have to store, treat, or destroy the waste, in accordance with Canada's current PCB storage and destruction or treatment requirements.

Goose Bay Project

The completion of the Goose Bay incineration project, which is being described in detail by another speaker here today, wraps up of an important phase of the Federal PCB Destruction Program. It resulted in the destruction of about 40 per cent by volume of the federal PCB waste inventory, at a cost of about $15 million.

Technology Assessment

As I have stated, technology exists to destroy PCB wastes efficiently and safely; however, another crucial part of our Program is an ongoing study of state of the art of PCB destruction technologies. In keeping abreast of new developments, we are able to better fulfill our commitment to helping the public to keep fully informed as well.

Although there are already several transportable incinerators available for commercial use in Canada; these units are costly to install and require large volumes of PCB wastes to make their application cost-effective. For this reason, we were very interested to determine if a smaller, more mobile unit could be used to address the problem of smaller volumes of PCBs which are stored in communities across the country.

To explore this possibility, Environment Canada, in collaboration with the Ministries of Environment in Ontario and Quebec, the hydro companies in these two provinces, VESTA Technologies Limited of Florida, and Chem Security (Alberta) Limited, signed a Memorandum of Understanding to test the ability of the VESTA 100 mobile incinerator to destroy PCBs to the regulatory requirements of the sponsoring agencies. The VESTA system was selected because of its ability to deal with relatively small volumes of wastes. These tests were carried out at the Alberta Special Waste Treatment Centre, near Swan Hills, Alberta. This was made possible thanks to the cooperation of Alberta's Minister of the Environment. If the tests are successful, it will mean that the VESTA 100 incinerator will be available for commercial use in Canada.

I must make it clear, that despite the Federal PCB Destruction Program's focus on mobile/transportable incinerators as the short term solution to Canada's PCB problem, the long-term solution must lie in siting permanent, integrated hazardous waste treatment facilities. Moreover, we do not see incineration as the only element of the PCB solution. Nor do we necessarily favour mobile equipment. The merits of all options will have to be considered depending on the particular circumstances.

Conclusion

In closing, let me say that the PCB problem, like the overall hazardous waste problem, is society's problem, and one that requires that we work cooperatively in order to resolve it. Like many other issues in society, the PCB problem exemplifies the conflict between the positive contribution these chemicals have made to society over the last six decades, and the threat that they now present to society.

The solution to the PCB problem is not indefinite storage, because there may be other incidents, such as the Saint-Basile-le-Grand fire. Incineration technology exists to destroy PCBs safely and effectively. What is missing is the social contract to get on with the job of siting such facilities.

The federal government is committed to an open process of public consultation in siting mobile PCB incinerators as part of the means of resolving the PCB problem. The Canadian public must in turn realize that they are the owners of a large part of the problem and must therefore be a major part of the solution in finding sites. This cooperation between government and the public is critical to the successful resolution of the siting problem.

THE CONSULTATIVE PROCESS FOR SITING A HAZARDOUS WASTE MANAGEMENT FACILITY IN MANITOBA: EXPERIENCE FROM MANITOBA COMMUNITIES

by

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Public Involvement in Hazardous Waste Management

The siting of hazardous waste management facilities is a highly contentious and conflict-ridden process. The traditional approach to siting hazardous waste management facilities has been largely unsuccessful. Typically, technical and economic decisions have dominated siting decisions and the public's involvement is solicited only after decisions have been made regarding location. Social considerations have been largely ignored. The public reacts to siting decisions with community resistance. Underlying this opposition to proposals, is the public's lack of involvement in the decision-making associated with the development of facilities. With the recognition that the siting approach needs to be reoriented from the technocratic approach to something which better factors social considerations into the equation, many jurisdictions are designing and implementing new processes.

In 1982, Manitoba began to address the hazardous waste issue with a staged program. This resulted in the collection of technical data on the nature of the problem, the development of a regulatory framework to manage the problem, and a series of public forums including seminars and public hearings to obtain public input on the development of a provincial hazardous waste management system. One outcome of the public hearings held by the Clean Environment Commission was the establishment of a provincial Crown Corporation as the proponent of the system. The Manitoba Hazardous Waste Management Corporation was formed in 1986 and became operational in late 1987.

Developing out of Clean Environment Commission recommendations, the Corporation designed a facility siting process which maintained the integrity of environmental, technical and economic considerations, but which factored social considerations in the equation at the very outset of the process. An underlying premise was that education and ongoing communication were necessary ingredients to successful siting, but more importantly, direct involvement of citizens in the decision-making associated with the development of the facility was a requirement. Community control was recognized as a critical factor in the facility's development.

Co-Management

The approach which was developed was termed a co-management process. Co-management is a concept which refers in general to a process which involves two or more parties working towards a particular goal or objective in a joint and cooperative fashion. In the case of hazardous waste management facility siting, it refers to the parties jointly examining a local area to determine if a technically, environmentally and socially acceptable site can be found. At the community level, it was through a local Community Advisory Committee that this process was developed. The assumption was made that a community would make its decision on the desirability of the project based on information gathered throughout the process.

A co-management process can start in a fairly informal manner and ultimately extend into a formal arrangement whereby the community and the Corporation will develop a contractual arrangement. This co-management agreement would include any conditions which the community has attached to its acceptance of the facility and which have been negotiated with the Corporation.

The principles of co-management as a siting process are as follows:

- the process is a voluntary one;
- the siting investigation proceeds at the rate at which the community feels comfortable;
- the community will establish a Community Advisory Committee to work with the Corporation in the site investigation;
- the Community Advisory Committee will independently address issues and concerns of the community;
- the Community Advisory Committee will independently provide a recommendation on the community's position respecting support of the development, usually to the elected municipal council(s); and
- the community will make its decision after it has completed its investigation and has all the information.

The paper will discuss the siting process to date. It will also describe the information gathering process that one community went through over the course of a year. The focus will be on the community decision-making process, factors which affect that process, and how a community deals with information. It will also address the question of whether a co-management process can successfully overcome the past siting failures as a new and innovative approach to siting hazardous waste management facilities. Some observations are made on refinements and improvements to the co-management process.

The Voluntary Approach

In the fall of 1988, the Corporation distributed its provincial screening results to all municipalities in the province as well as numerous stakeholders. Areas with the greatest potential for hosting this kind of development were identified. The offer was made to communities if they wished to consider this development, to contact the Corporation. The result was an overwhelming response.

To gauge community interest in the project, Open Houses were sponsored by 35 communities, either singly or in groups. Questionnaires were administered to determine the level of interest. The Open Houses were run from 3 p.m. to 9 p.m. and were usually staffed by 6 Corporation personnel with different areas of expertise. In general, the Open House format was successful in that people had the opportunity to have their questions answered and usually left feeling more comfortable with the proposal particularly given the offer of co-management. The Corporation did not define specifically what the community's role and functions might be in the development and operation of the facility, but rather made the offer to the communities to examine these matters in their investigation.

Formation of a Community Advisory Committee was the next step after determining a sufficient level of support for investigating the project. We requested Councils to select the Community Advisory Committee membership to ensure that different interests, viewpoints, and expertise of the community were represented.

For communities that became seriously involved in the process, the two factors of investigating the proposal until the community had completed its investigation, and the opportunity to provide community support for the project at the end of the studies, had particular appeal and may have been the main reasons for attracting and maintaining community interest.

The Consultative Process Experience

Community Dynamics and Social Impacts of the Process

As of September 1990, the Corporation is working with two rural communities and the City of Winnipeg. Each community is at different stages in its investigation. A number of other communities have also expressed interest in becoming involved. Every community that we have worked with or are working with, has reacted and responded differently to the process. Four Community Advisory Committees became active in the process and each developed differently, reflecting the community's own dynamics and also the dynamics of the process. Two communities opted out of the process through early referendums.

The following discussion is based on experience from one community. The definition of community in this case is the political jurisdiction of a Village and surrounding Rural Municipality (population 1500). This community worked within the process for one year from the time of its first Open House to the time of an early referendum. The referendum was called by the Rural Municipality, in part because of pressure being put on individual Councillors from both within the community and from outside the community. Also, there was precedence from another community which held an early referendum. The early vote asked Village and Rural Municipality residents (approximately 1200 voters including non-resident landowners) if they wished the community to continue with its studies on the siting of a phys-chem treatment plant for hazardous wastes in the Rural Municipality. There was a 68% turnout. The results were as follows: 36% said no, 32% said yes, and 32% did not vote. In the final analysis, the vote did not indicate whether the community voted against the facility or against continuing a very public process involving community conflict.

There are a few comments that can be made regarding community dynamics. Underlying any community discussion of this project are the social and cultural characteristics of a community and the psychological makeup of the individual. Rural agricultural communities go through a yearly agricultural cycle. Life is predictable and change is not apparent. Introducing a new proposal in a very public process can have a major impact on a community. Normative behaviour in small rural communities determines how individuals and groups deal with one another, except for those who do not share those norms. An outcome of this is that in a community controversy, the opposition do not play by the rules. Another outcome is that an attempt to avoid conflict and controversy is made by many individuals. Those who become very challenged by the prospect of change become the main participants in the siting process and later on the main supporters of the facility.

The Information Gathering Process

The Community Advisory Committee went through a few phases in its investigation. During the first phase, the Committee worked with the Corporation on designing the technical and social site selection criteria to reflect local concerns, interests and constraints. A reconnaissance drilling program overseen by a local drilling committee was undertaken to gain a better understanding of the local hydrogeological conditions. Before proceeding with a detailed site assessment, it was felt that more discussion was required in the community to address issues and concerns. Local reaction intensified following identification of potential sites.

Towards the end of this first phase, the Corporation completed its provincial waste market study and its engineering consultants completed the preliminary design of the facility. A model of the facility was then built. The facility was now known as a phys-chem plant, designed to treat approximately 14,000 tonnes of primarily inorganic waste annually. When the community began its investigation, the proposal was still very much conceptual. Information was communicated back to the community through the use of Open Houses, the local newspaper, and mailers to each home.

The Committee sponsored a bus trip to Swan Hills, Alberta. This gave residents the opportunity to tour a hazardous waste management facility and also talk to local residents and Town officials.

It was not until the Committee became more comfortable with what was being proposed, that they felt it was time to initiate their own studies. The first phase of their investigation took six months. An organized opposition formed in about the third month.

Four main areas were addressed through independent studies:

- an independent assessment of the Corporation's hydrogeological site selection criteria and the hydrogeological conditions of the Rural Municipality;
- community control and potential contract framework;
- property value protection; and
- economic impacts of the proposed facility.

The Committee developed terms of reference for the studies and selected its own consultants. Funding for the studies was reimbursed by the Corporation. The studies were conducted over a two to three month period. While the local opposition group was asked to participate in the studies, they chose not to participate. The timing of these studies became crucial as the early vote had been called by the Rural Municipality to determine if the community wished to continue with its investigation. The Committee had barely completed its studies and had little opportunity to communicate the results at the time of the referendum. Results were summarized and published in the local newspaper and distributed to all residents, but there was little opportunity for public discussion.

The Committee wanted to obtain independent opinion regarding the suitability of the area to host such a development. Also the Committee wanted to examine the opportunity for community involvement in the operation and management of the facility. This was intriguing and challenging. These two community concerns came about due to criticism of site selection criteria and people's skepticism that a community could in fact enter into a legally binding contract that would give them significant control.

The issue of economic impacts was not in the forefront initially as everyone recognized there would be benefits forthcoming. The issue became more important later on in the process when it became more apparent to those who were seriously examining the community's future that their community and all of agricultural Manitoba was undergoing change. Depopulation and a dwindling farm economy were impacting communities and it became recognized that a diversified economy was going to be necessary if the community was to stabilize and prosper. During the process, a healthy community discussion never developed revolving around the community's future.

The property value protection issue was one of the first issues to emerge. This was a concern particularly given the ageing farm population seeking retirement and the current farm economy. The design of a property value protection program was a true success story in terms of involving potentially affected individuals in a process to resolve a local issue. In principle, the Corporation supported the concept of property value protection. However, we felt this program should be developed at the local level with the involvement of potentially affected individuals. Through a local realtor, a group of individual farmers designed a property value protection program over the course of several months. Individuals from neighbouring municipalities also participated in the design process.

These four studies were important overall to the process. They demonstrated a community's ability to address local issues from a community perspective. They demonstrated the Corporation's commitment to the community to enable it to independently examine issues. They also forced certain issues out into the open and heightened an underlying negotiation process between the community and the Corporation.

These studies addressed concerns which the Community Advisory Committee felt were important at this stage of the community's investigation. Throughout the process, the local opposition group raised various concerns. They used a number of communication means such as local mailers, newspapers, or public meetings. Underlying many concerns are fundamental issues of trust, fear of the unknown, individual security, and an unwillingness to change the status quo. Many siting issues are also of a philosophical nature. Throughout the process, the opposition group searched out information and opinion to support their beliefs.

Some of the opposition group's positions are mentioned briefly. Agricultural Manitoba is pure, pristine and unpolluted. We cannot risk harming our environment. We cannot afford to take agricultural land out of production. Winnipeg produces the majority of the waste and therefore should be responsible for managing it. Also, it has all the infrastructure to handle emergencies and all the political clout to ensure the facility will be properly monitored. Our local facilities cannot handle an emergency. The transportation risk is too great particularly as the trucks have to travel through agricultural Manitoba. There is no assurance that the facility would not be sold. Nothing is infallible (i.e. technology is fallible). There is always the possibility of human error. Farmers would be unable to market their products. The community would be viewed negatively. Our community has always survived and always will and does not need this kind of development. The risks far outweigh any benefits.

At the community level, there is information from the Corporation, the Community Advisory Committee and the local opposition. Also, information was being collected through a local office staffed by a community resource person. Added to this information gathering, however, are a number of external factors which provide information to the community and ultimately affect the decision-making process.

External Factors Influencing the Decision-Making Process

In their search for information, communities are affected by external factors, some of which are solicited and others which appear voluntarily. Several outside influences have been identified. While further analysis has not been undertaken as to the significance of these factors individually, as a cumulative influence, they could have a major effect on people's decision-making. They influence the process by adding distractions which in turn influence people's rational search for information. People's ability to carefully and in a reasoned manner consider the merits and drawbacks of the project is affected. A community can be vulnerable to outside pressures. Experience suggests that after going through a siting process, communities change. Individuals collectively might now challenge information sources to a greater degree.

Neighbouring Communities

A basic issue for neighbouring communities is that they would have to accept all the risks and receive none of the benefits. Neighbouring communities do not consider themselves as stakeholders. Mobilized public opposition from neighbouring communities can be a significant factor influencing people's information gathering process. This can result from the host community mobilizing outside opposition, or the neighbouring community forming its own opposition. Regardless, the two groups work together in a manner that can create sufficient background "noise" to the issue. The end effect is that organized advocacy takes over from normal community relations between communities.

A response used was to involve local Councillors from neighbouring municipalities as observers on the Community Advisory Committee. At that level, the community could remain informed and also feel part of the process. Involvement of neighbouring municipalities in the design of the property value protection program demonstrated that communities could collectively resolve issues of interest to both. There was a definite sense of satisfaction that the individuals felt in reaching consensus through a problem solving exercise.

Academic Community

Another outside influence was derived from the academic community. Academics from Manitoba Universities voluntarily became involved in the discussion particularly at the philosophical level. Comment by them appeared in published form through the local and regional newspapers. When seeking support for a position to oppose something, particularly a proposal by a government agency, if some verification can be mobilized by people with titles and credentials, it becomes easier for those opposed to publicly display their position. However, interestingly, the academics are not stakeholders in the process and generally once they have said their piece, they disappear. Issues often raised were already being answered through the co-management process.

One reason why academics became involved in rural Manitoba was because they felt the community was not equipped to deal with the process. There was little understanding of the community, the process, or recognition of the ability of a community to participate in the process and make an informed decision. For those individuals who were supporting the siting process, this kind of attitude was demeaning; and for those individuals opposing the process, this third party support served to verify their position.

Politicians

The provincial politicians chose not to become involved publicly. Given the sensitivity of the issue, this can be considered a normal political reaction. However, as there was no support out there, so to speak, from the elected provincial officials in terms of the siting process, a community could feel quite isolated. It has been suggested by individuals in the community that if some public support was visible, many of the other outside influences may not have appeared or the community may have felt stronger support for its investigation.

Environmental Community

There has been fairly minimal involvement of the Manitoba environmental community in the siting issue in rural communities. Environmental organizations tend to support the philosophical argument that a facility should be located close to source. There is also the issue of reducing the quantities produced. Support for both of these arguments is easily attainable and is also consistent with the Corporation's system development strategy. However, it raises the issue of waste regulations, industry's responsibility and the need for off-site facilities. This requires a fairly indepth analysis of hazardous waste management which many people are not interested in. But, raising these issues causes some confusion as to what current practices are and what is hopefully achievable and why.

It has been our experience that environmental organizations are more willing to address the issue of siting in a large urban centre such as Winnipeg for the philosophical reasons discussed above. Their interest is not to become involved in debates regarding economic benefits or economic diversification opportunities. However, on such occasions of becoming involved in rural community debates, there was a clear recognition that a small community could become an effective joint partner in the development and operation of the facility.

The Government and the Regulators

The Department of Environment regulates hazardous waste through the Dangerous Goods Handling and Transportation Act. There has been minimal involvement by the government or Department at the public level. A number of concerns were expressed by residents regarding the Department's role. First of all, the public wants to understand what the regulations are and whether they are enforced. There is a general mistrust of government and its ability to properly enforce regulations. The absence of the government in the overall siting debate may have lessened people's faith in the siting process simply because they could not see a visible third party. Major actors in the management system were on the sidelines. The lack of third party involvement supporting the investigation and also demonstrating the regulatory oversight to the proposed facility, enhanced the we and they dispute between community groups at the community level. This is because it can be made to appear as if those who are committed to the process are supporters at whatever cost and are simply following the Corporation's agenda to site the facility.

The Media and Other Information Sources

There are numerous sources of information which can cast some doubt in people's minds particularly regarding the operation of facilities, safety and environmental impacts. Past experience particularly with improperly managed facilities can reinforce people's skepticism. The offer of co-management in the development and operation of the facility was made to ensure community involvement in all aspects of the facility's development and to ensure information disclosure. However, while some people are challenged by this, others are less trusting and unwilling to change the status quo.

The media as a source of information served to portray communities to the outside world. The media loves conflict and communities were portrayed as being divided. There are many emotional reactions to this kind of portrayal. For some, there is anger at not being fairly represented and for others there is a feeling of satisfaction and hope that the issue may go away. Many people do not like to see their community portrayed in a negative manner no matter what their position is on the proposed project. However, the media attention adds a negative dimension to the process. Articles are never or are rarely written on how a community is taking a responsible look at the waste management issue.

Anonymous mailers arrived in people's mailboxes. These were not well received. While fear mongering as a tactic was not utilized that often, people's reaction to it was how could that be going on in my community. Anonymous literature once again added some emotionalism to the discussion.

The local newspaper became a source of technical discussion. Selective quotations from expert sources were placed in newspaper columns or letters to the editor. For example, it was often stated that "all landfills leak". At the same time, there was no discussion of what type of landfill was being proposed with the hazardous waste facility. Those who were interested in the project became aware of the risk of the local municipal landfill which burns continuously and is not sited with groundwater protection in mind. This allowed them to place the hazardous waste facility in a relative risk perspective. Interestingly, the issue of relative risk was raised often by supporters of the project when they examined farm chemical use and other facilities and industries located in agricultural Manitoba.

Local newspapers were used by the Community Advisory Committee which placed articles on the results of their independent studies. Some debate also ensued in attempts to correct misinformation. This medium can have the effect of adding to the confusion when different opinions and facts are stated. Once again, it brings the everyday citizen into the information gathering process, but the information may or may not influence his or her decision making. What may be more influential is the demonstrated community controversy.

Co-Management and the Decision-Making Process

One of the objectives of the co-management process was to give communities control over the decision-making associated with the development of this facility. The process was developed with the recognition that public acceptance of a facility is a requirement to successful siting. Past failures have resulted from the Not In My Backyard Syndrome (NIMBY) which in part may be derived from personal and selfish motives, but which also results from communities not being involved.

Does co-management resolve this NIMBY syndrome? Experience from this community and others which we have worked with suggests that it does. While we have not yet been successful in siting the facility, the process has offered communities significant involvement and the opportunity to make their own decision. People are not only willing, but they become challenged by the opportunity. However, as has been discussed in the case example, there are many factors both internally and externally which affect the community's decision-making process. The search for information and the process of negotiating a co-management agreement can become almost secondary to the community controversy. When a vote is used to determine community support, there is nothing that suggests people have to be rational or base their decision on information.

The post-vote experience in this community is interesting. There is more discussion at the individual level. Perhaps this is because the issue has now gone away and people are now more comfortable talking with their neighbours. Most people feel that the vote would carry if it was called today. Perhaps this is because there has been a period of reflection and discussion and the momentum has died down. Also, the discussion is not being carried out within the larger stage which makes individuals uncomfortable. The supporters of the project feel that they were not active enough in the investigation and realize that the Advisory Committee was carrying most of the weight and ultimately became the community's proponents of the project.

The community recognizes it is better off having gone through this process. Viewed as a system, the process was the perturbation to that system. The end result is change. Many people do not recognize that change can be positive. I have been told that individuals feel more informed on environmental issues, hazardous and solid waste management in their local vicinity, community development, and economic diversification. People are also doing something about these issues at the grassroots level, recognizing that community development begins with people and ideas in the community.

Discussions in other communities that we are working with have not developed to the level reached in this community. This is not necessarily a good thing. It suggests that communities respond differently depending on many factors including their own dynamics. Controversy and conflict can be healthy. Co-management has not lessened controversy in the facility siting process, but it has reduced the conflict between proponent and community. However, conflict is evident at the community level.

There are some observations that can be made based on experience with this community. These are lessons learned from dealing with a progressive, challenged rural community that entered a high level of discussion on the issue.

The community may need to have a discussion at the outset of the process on the community's future. Overall, the community may need a collective objective for looking into this project. As was mentioned previously, many people want to maintain the status quo and feel threatened by change. Some people simply do not want development. Those who were positive and forward thinking individuals viewed this as an environmental protection industry, an economic diversification opportunity, and a positive addition to their community.

The co-management process was very loosely arranged. There is no obligation on the part of communities to stay in the process until the investigation is complete. A contract framework spelling out obligations on the part of the community and Corporation could resolve this dilemma. This would ensure that a community does not opt out at the height of the controversy. Mechanisms such as mediation could be utilized for resolving internal disputes. With a loosely defined process, there is no obligation on the part of anyone to get to the table. A staged process may allow a community to go through the peaks of controversy and reach true community consensus.

There is a problem of offering a technological discussion out to the community as many people attempt to become technical experts. The debate can become one of technical challenge which essentially revolves around issues of trust in technology, the proponents, and the regulators and confidence in their community's abilities to become involved in the management of the project. There may be a need to involve third party expert bodies to assist the community with its concerns and understanding of technical material. A community may not be able to wait for the Environmental Impact Assessment hearings to deal with technical issues that turn into community debates. Involving the Advisory Committee in all studies and also providing resources for independent study does not prevent proliferation of rumours and distribution of opinion and misinformation. Mini-hearings would serve to force concerns out in a publicly adjudicated forum.

Third party support for the process is important for the community. Otherwise, it can feel quite alone and less able to defend its position of examining the project particularly to its neighbours. The lack of involvement of the government and the regulators adds to the mistrust people have of government and its enforcement of regulations. Our experience is that it is also easier to mobilize external opposition in a controversial issue than it is to mobilize external support.

The information gathering process is influenced by a myriad of factors. Emotion and public controversy can easily influence one's decision. While co-management offers the opportunity to gather all the information a community needs, the end result is that information about the project may or may not form the basis of each individual's decision. The above suggestions are refinements to a co-management process which should assist any community reach a consensus which is consistent with its own community's goals and objectives.

CONCEPTION BAY CENTRE
WASTE MANAGEMENT SYSTEM

by

Ken Dominie, P. Eng.
William Noseworthy, P. Eng.

Background

In 1974, the Newfoundland Department of Provincial Affairs and Environment (now the Department of Environment and Lands), recognizing that there was a problem with solid waste disposal in an area known as Conception Bay Centre, commissioned the Consulting Engineering Firm of Newfoundland Design Associates to conduct a study into the matter. The objective of the study was to inventory all waste management systems and problems in the area and to make recommendations on establishment of an integrated waste management system to service the entire area.

The study area was comprised of 18 communities, nine of which were incorporated and nine unincorporated (ie. having no form of local government). This latter group of communities however were organized into two separate Waste Disposal Communities under the Waste Material (Disposal) Act to provide a vehicle by which they could handle their domestic waste in some organized fashion.

The total population of the study area was approximately 14,000 people with individual communities ranging from a low of several hundred people to a high of just over four thousand. A breakdown of the communities and their populations is shown in Appendix A. As can be seen from that Appendix the individual communities are very small and as such it is very unlikely that they could afford to construct and operate a waste disposal system in an environmentally acceptable manner.

The Study Findings and Recommendations

Through a series of calculations and measurements it was found that the generation rate of solid waste for the study area ranged from approximately 1.27 to 5.35 lb/capita/day. On the average it was estimated that 3 lb/capita/day was a reasonable rate and this figure was used for design purposes. Based on this generation rate, daily generation of waste is approximately 42 000 lb or 21 tons.

Newfoundland Design Associates in their search for alternate disposal methods for the waste narrowed their investigation down to three alternatives:

1. Composting
2. Incineration
3. Sanitary Landfilling

Other methods of waste management such as shredding, baling, recycling, etc. were mentioned in the study but were not considered in any detail. The final analysis of the three disposal methods noted above indicated that sanitary landfilling was the most appropriate method of waste disposal for the study area. Accordingly, Newfoundland Design Associates spent considerable time searching for a suitable site in the area. In all, some 13 sites were investigated of which two were found to be suitable for the area needs. The Department accepted the Consultant's recommendations and began the process of establishing a regional landfill for the entire study area, the cost of which was estimated to be $650,000 over the life of the facility.

The Implementation Process

Although a number of attempts were made to implement the recommendations of the report in the days and months immediately following its acceptance, the Department did not meet with much success in its efforts. The reasons for this unsuccessful effort may be categorized under three separate headings:

1. Rejection by local residents in whose area the facility would be located. (NIMBY)
2. Lack of understanding of the sanitary landfilling method of waste disposal
3. Lack of co-operation between the various communities to come to a common solution to the problem.

The first two points above are connected as local residents' perception of landfilling was based on their past experience with poorly operated systems in the area which may have been little more than open dumps with all of their inherent problems of scavengers, fires, flies, rodents, etc.

On the third point, it was a very difficult task to convince the community leaders of the area that the waste disposal problems of the area were common to all communities and because of the physical characteristics of the area and economic reasons, proceeding on individual bases would be very difficult if not impossible if any environmentally acceptable waste management system were to be implemented. To overcome this problem would, as it proved out, require a significant amount of Departmental staff time as the implementation process continued.

While the Department officials were somewhat disappointed over their unsuccessful efforts to establish a regional landfill facility, they still felt strongly that an integrated regional approach to the problems of the area was necessary if they were to be solved efficiently. Accordingly, a fresh review of disposal technologies was undertaken by contacting other Provincial and Municipal governments and equipment suppliers in Canada to ascertain what was available and to learn of the success or failures of others.

At the end of this review, the process of "pit incineration" technology appeared to show some promise. Officials of the Department made several trips to similar size areas where these incinerators were in operation. - Port Colbourne in Ontario and Ste. Eustache in Quebec. After a thorough review of these systems it was recommended to government that this technology be applied to Conception Bay Centre area and approval for such was subsequently given .

After receiving approval to proceed with what was considered to be advanced technology for the Province at the time, Department officials once again began the site selection process. As it turned out, the local residents still had major objections to establishing any regional waste disposal facility in their area. With every site came the usual objections: the smoke from the unit would affect them, the extra traffic through their communities would be a safety hazard for children, wastes falling from trucks would litter their communities, etc. There was, however, more of a recognition among community leaders that the problem was a common one and that a common solution would make more sense than individual communities proceeding in their own directions.

All throughout the summer of 1978, a number of sites were visited and revisited with local residents but with no success. It appeared that the incineration option was about to suffer the same fate as the sanitary landfill.

At the same time that this site selection process was proceeding, the Town of Harbour Grace which lay just outside the study area approached the Department for a solution to their waste disposal problems. They had been operating a teepee type incinerator and it had become completely dilapidated. They had heard about the newer pit type incinerator and were anxious to see if it would satisfy their needs.

Negotiations then began with Council of Harbour Grace and the other Councils in the area for the establishment of regional pit incinerator on the site of the existing teepee unit and agreements between all parties and government were signed by mid 1979.

With the exception of objections from a nearby farmer who expressed concern that fly ash may contaminate the grass which his cattle grazed upon, there was very little public opposition to the site.

With the long and sometimes arduous site selection process completed, the final green light for the project was given.

The Project

The incinerator facility was designed to burn 72 tons of waste per day in two burners. Each burner consisted of a refractory lined "pit" which utilized both under and over fire air to aid in the combustion process. The air was provided by fans driven by 100 h.p. motors on each burner.

The facility also included a steel and concrete block building into which all of the waste was dumped to avoid littering of the site by wind, scavengers, etc. The waste was to be charged directly from the floor of the building into the top of the incinerator by a front end loader. Provisions were made in the design of the incinerators for a "drive through" method of clean out and the ash to be landfilled on site. It was anticipated that the incinerator would reduce the volume of waste by 85% and provisions were made in the disposal area for a minimum of 20 years of ash disposal. There is another area available in the immediate area of the facility for additional landfill should it be necessary.

A construction contract for approximately $750,000 was let in late 1980 and the facility was officially opened in June of 1981 - some seven years after the concept of a regional facility for the area was contemplated.

Subsequent to the main contract being let, other funds were committed for site work, fencing, access road, paving, etc. which put the project cost just slightly over $1,000.000.

The Facility Today

After 10 years of operation the operator facility is well stabilized and is accepted by the local area residents with little concern. Over the years there have been periodic complaints about smoke and recently the Fire Department of Harbour Grace expressed concern over fly ash having the potential to cause grass fires. As a result of this concern the buffer zone around the site was enlarged.

The participation in the facility has increased since its original inception and it now services some 30,000 people in 23 communities. The facility operates 9 hours per day 5 days a week. The operator of the facility has a schedule of the trucks arriving from each community and is able to schedule his maintenance to coincide with low volume days. In the immediate past there has not been any occasion to landfill raw wastes and the operator ensures that all wastes arriving on site are either burnt the same day or stored overnight inside the building (which is a very rare occasion). This management of the disposal practices has vertically eliminated any rodent problems. In addition to the regularly scheduled wastes, individuals can use the facility on a user pay basis.

The facility is run by an autonomous association which elects its Board of Directors from eight of the largest municipalities using it. It was felt that it would be too cumbersome to have all 23 communities represented on the Board. This arrangement appears to be working and any participant who is not officially represented on the Board can address any concerns through any one of the Directors.

The fees to utilize the facility are based on population plus the number of businesses in any particular community. The current rate is $9/capita + $30/business on an annual basis. For example a community of 5000 with 200 businesses would pay as follows:

5000 x 9 = $45,000
200 x 30 = $ 6,000
$51,000/year

The communities are billed on a monthly basis, taking the annual amount and dividing by twelve.

In addition to the billing to the communities, individuals/contractors/private disposal companies etc. using the site pay as follows:

Compactor truck = $45/load
Dump truck = $10/load
Pickup truck = $ 5/load
Car = $ 1/load

Collection of fees and issuance of receipts for these individuals is all done on site.

The facility currently costs approximately $300,000/year to run, with major costs being wages and repairs to the burners. The Revenue and Expenditures Statement for 1989 is shown in Appendix B. At present there are four permanent employees at the facility:

- Office Manager
- Foreman
- 2 Operators

The Association which manages the facility meets regularly to discuss issues that arise.

10 Year Evaluation of the Facility.

The opportunity to give this paper at this the 12th Canadian Waste Management Conference is quite timely as it gave the Department an opportunity to review the Conception Bay North Waste Management System and reflect on its high and low points over 10 full years of operation in order to evaluate its overall success or lack of such.

While there has been a number of problems with the operation of the facility over the years and the operating costs have been higher than originally anticipated, the 10 years of experience with this type of equipment has given those involved more knowledge of what to expect from it and if success is measured in the fact that some 30,000 people are more willingly and quite independently working on solving common waste management problems then surely one must say that the exercise has been successful. Indeed the administrative framework that has been established by the local people to operate the system may serve as a model for other areas of the Province wishing to establish a joint facility.

From a technical standpoint however, one may not give the facility high marks if it were compared to some if the more sophisticated incinerator facilities and standards for such which have evolved over the past decade. However, economics would probably dictate that such modern facilities would not be anywhere near being feasible in a rural area such as the one described in this paper. The establishment of this facility even with its marginally higher than desirable emissions, and variable operating conditions is felt to be acceptable when one considers the options that were available to solve the problem of the time.

I hope this paper has demonstrated how the Province of Newfoundland took what is felt by some to be a quantum leap financially in overcoming a NIMBY Syndrome solving the waste disposal problems of a small number of people. Much was learned from the exercise which could certainly assist in any similar projects in the future - more particularity in the area of participation of the area residents. It is firmly believed that these people now see the benefits of a co-operative effort and it will be very interesting to see how they react at the end of the life of this facility.

Appendix A

Community	Population (1974)
Incorporated Communities	
Cupids	708
North River	265
South River	625
Clarke's Beach	908
Tilton	511
Spaniard's Bay	1783
Bay Roberts	4058
Upper Island Cove	1832
Bishop's Cove	359
Sub-Total	11,049
Unincorporated/Communities	
Port De Grave Peninsula Committee	
Bareneed, Port De Grave Hibb's Cove, Ship Cove, Blow Me Down, Pick Eyes and the Dock	993
Butterville Committee	
Butterville, Shearstown	2009
Sub Total	3002
Total	14,051

Appendix B

Conception Bay North Incinerator Association
Statement of Revenue, Expenditure and Deficit
For the Year Ended September 30, 1989

	1989
Revenue	
Incinerator Fees	$292 670
Government grants re interest on loans	29 770
	322 440
Expenditure	
Office salary and expenses	21 843
Salaries and related costs	82 013
Repairs and maintenance	49 277
Telephone	1 120
Heat and light	29 577
Fuel oil	5 990
Insecticide and pest control	865
Insurance	1 038
Entertainment and general	3 242
Interest and bank charges	6 682
Interest on long-term debt	36 296
Debt reduction - loader	9 438
Snow clearing	1 870
Directors' fees	8 950
Professional fees	1 075
	259 276
Excess of revenue over expenditure (expenditure over revenue) for the year	63 164
Deficit, beginning of year	97 951
Deficit, end of year	$ 34 787

LE NIMBY, UN PRODUIT DE LA SOCIETE D'INFORMATION

par

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INTRODUCTION

Le NIMBY paralyse certains secteurs d'activités de notre société, présentement. Il monopolise beaucoup trop d'énergie, provoque des bouleversements sociaux très intenses, des coûts directs très élevés (on parle de 500 milliards $ strictement pour l'implantation du nucléaire aux États-Unis)(1). Il a même des effets insoupçonnés sur le prestige de la technologie québécoise sur le plan international. Un représentant de notre firme localisée à Singapour nous informait des difficultés qu'il avait à faire la commercialisation de nos technologies suite à l'envoi de nos BPC en Angleterre. Je n'accepte pas que nous puissions démontrer notre capacité d'aller sur la lune et par contre, demeurer incapables de résoudre des problèmes de relations et communications socio-politiques. Il faut, de toute urgence, que nos sciences sociales rejoignent le niveau de nos compétences techniques(2).

Notre analyse doit donc porter sur les principales caractéristiques de la société d'aujourd'hui.

Mon hypothèse stipule que la SOCIÉTÉ D'INFORMATION dans laquelle nous vivons présentement comporte des changements importants qui nécessitent pour nous de nouveaux comportements et attitudes. Sans cela, nous continuerons à être confrontés à des problèmes, tel que le NIMBY. La SOCIÉTÉ D'INFORMATION caractérisée par l'omniprésence des media et des communications a des conséquences importantes par la démocratisation du processus politique, par une "complexification" du processus d'administration publique et par l'obligation de l'entreprise privée à être plus imputable socialement. Il faudra agir à la fois dans chacun de ces secteurs pour réussir à maitriser un phénomène comme le NIMBY.

1.0 LE NIMBY

1.1 DÉFINITION

Le NIMBY, c'est l'incapacité pour les entreprises, les gouvernements, les media et les citoyens de s'adapter aux nouveaux comportements et aux nouvelles valeurs et exigences de la SOCIÉTÉ D'INFORMATION.

Il s'agit de comportements individuel et collectif devant l'implantation d'équipements ou services qui se manifestent comme suit:

a) un sentiment d'injustice sociale à l'effet qu'une communauté doit supporter les responsabilités d'une autre communauté et/ou d'une plus large. Je fais ici abstraction des considérations où, pour des facteurs techniques et d'économie d'échelle, l'on doit accepter des équipements de taille minimale.
Ex.: Les gens de Baie-Comeau qui refusent les BPC de Saint-Basile;

b) un sentiment d'humiliation et de dévalorisation sociale car cette communauté est pointée du doigt et perçue comme de seconde classe dans les media et sur la place publique.
Ex.: Les Britanniques qui s'exclament "Nous ne voulons pas être la poubelle du monde";

c) un sentiment de crainte et d'inquiétude basé sur un manque

d'information scientifique crédible ou tout simplement factuelle et complète.
Ex.: Les 6,000 signataires d'une pétition s'opposant à la venue de Stablex à Blainville sans avoir obtenu toutes les informations scientifiques;

d) un sentiment de non confiance envers les administrations publiques, les administrations privées et les élus.
Ex.: Le refus des citoyens d'accepter les études d'impact dans le projet d'usine d'épuration des eaux usées de la Communauté Urbaine de Québec;

e) un sentiment de force que représente l'opinion publique pour participer au processus décisionnel public.
Ex.: Opposition des citoyens au projet de réutilisation des résidus organiques dans des fours à ciment à Joliette;

f) un sentiment de perte potentielle de valeurs immobilières et de ralentissement du développement général de la communauté.
Ex.: Crainte des citoyens d'une perte de valeur de leur maison à la venue de Stablex à Blainville; et
les citoyens de Varennes s'opposant à la venue de Soligaz;

g) un sentiment d'opposition devant des erreurs d'aménagement du territoire.
Ex.: Les citoyens de Mirabel opposés au choix du site et à l'étendue des terrains expropriés;

h) un sentiment d'opposition devant l'implantation d'un projet ou d'une technique non sécuritaire.
Ex.: La disposition des déchets bio-médicaux dans des sites d'enfouissement traditionnels;

i) un sentiment d'opposition devant des processus autoritaires, des administrations publiques et privées.
Ex.: Les gens de South Cayouga en Ontario s'opposant à l'implantation d'un centre moderne de traitement des résidus industriels;

j) un sentiment d'opportunisme ou de partisanerie politique.
Ex.: La mairesse d'une ville de Nouvelle-Écosse, pour se faire élire, s'est opposée à un site d'enfouissement. Elle confirmait plus tard que le site finalement choisi était de qualité inférieure à celui dans sa cour auquel elle s'était opposée(3).

1.2 LES CAUSES

Je dois dire au départ que pour moi, le NIMBY est souvent attribuable à des négligences des entreprises et des gouvernements. Je comprends très bien une communauté qui s'oppose à la venue chez elle d'un équipement qui n'est pas démontré comme sécuritaire, qui est mal localisé selon le zonage et l'aménagement du territoire, qui est proposé par un promoteur non crédible et non transparent et qui n'a pas fait l'objet de la part des administrations publiques d'un processus d'information, de consultation et de participation, mais ces causes relativement évidentes ne suffisent pas à expliquer l'ampleur du phénomène NIMBY.

Dans la recherche de causes pour expliquer le NIMBY, il faut aussi dépasser les phénomènes de résistance au changement que l'on a observés à travers l'histoire devant l'évolution de la technologie, tel les Luddites qui détruisirent les moulins au 19e siècle en Angleterre ou les citoyens d'Hazeltown aux États-Unis qui votèrent par référendum contre le remplacement du gaz par l'électricité. C'est en examinant la société d'aujourd'hui que nous pourrons identifier les caractéristiques et les facteurs qui favorisent le développement rapide et fréquent du NIMBY. Or, ce qui caractérise la société d'aujourd'hui, c'est l'envahissement des technologies de communication, d'information et de la connaissance, qu'on a résumé sous le vocable de SOCIÉTÉ D'INFORMATION.

La SOCIÉTÉ D'INFORMATION, selon Toffler qui a écrit "La 3e Vague" et Naisbit qui a écrit "Megatrends", accélère le rythme de notre évolution et rend complexe la compréhension des phénomènes sociaux. L'information, dont sa diffusion dans tous les sens est facilitée par les technologies modernes, serait le facteur déterminant de cette transformation sociale. Les media, parmi les divers réseaux d'échanges, seraient prépondérants dans ces grands mouvements. Examinons de plus près les media pour mieux saisir leurs interactions et relations avec la réalité quotidienne.

1.2.1 LES ACTIVITÉS MÉDIATIQUES

L'on pourrait se poser la question suivante: "Watergate et les événements de démocratisation de l'Europe de l'Est auraient-ils eu lieu sans l'existence des media?" Andrew Simon, de Radio-Canada International, attribuait aux media un rôle important dans l'accélération de l'histoire des pays de l'Est.

Impact non encore soupçonné et évalué, les media sont eux-mêmes en constante évolution et s'interrogent sur leur façon de faire. Walter Cronkite regrettait l'action partielle des grands réseaux de télévision qui ne diffusaient que des manchettes. D'autres études révèlent que le citoyen moyen regarde la nouvelle, il ne la lit pas(4). Récemment, une dizaine de personnalités invitées à donner un avis au Conseil de presse du Québec déclaraient "l'information se devrait être de la formation"(5).

Quoiqu'il est difficile de mesurer les types d'impacts négatifs ou positifs des media, nous pouvons toutefois constater l'omniprésence des media et leur rapidité d'action. Ex.: (un journaliste américain, dans son bureau à Washington, à quelques pas d'où avait lieu la tentative d'assassinat du Président Reagan, apprenait l'incident par un appel téléphonique de son bureau de Londres).

Si le citoyen des sociétés passées était alimenté par le curé, sa famille et les notables, par après, par les journaux, la radio et la télévision, Toffler nous dit qu'aujourd'hui "le citoyen est assailli par des fragments d'images contradictoires ou décousues qui ébranlent nos vieilles idées, nous mitraillant sous forme de "blips" incohérents ou désincarnés"(6).

A cet égard, le citoyen est souvent dépourvu devant la nouvelle. Laissez-moi vous donner quelques exemples dans le domaine qui nous concerne, soit l'environnement.

1.2.1.1 L'EAU

La Presse, 20 janvier 1989 titre "l'eau minérale naturelle est dangereuse". Or, la population a augmenté la consommation d'eau minérale lorsque des nouvelles lui indiquant que l'eau distribuée par plusieurs municipalités était non propre à la consommation.

1.2.1.2 LES RAISINS DU CHILI

Time Magazine, Mars 1989

Des gens croyant être empoisonnés par les raisins du Chili attendaient pendant des heures l'examen du médecin. Lorsqu'on leur a dit que le cyanure suspecté dans le raisin agissait en-deça d'une à deux minutes, ces gens comprirent que leurs maux d'estomac et de tête étaient artificiels car ils avaient consommé le raisin 3 jours auparavant.

Cette panique avait causé une perte de plusieurs millions et effrayé tout un continent. La quantité de cyanure trouvée dans un raisin était si petite que le maximum qu'elle pouvait causer était quelques colliques à un bébé.

1.2.1.3 LES LÉGUMES

L'oeil régional, 20 août 1989

"L'incendie de l'entrepôt de BPC de Saint-Basile: moins dangereux que les légumes du marché".

1.2.1.4 LES COUCHES JETABLES

L'Actualité du mois de novembre 1989 titre "Les couches jetables de papier non blanchi sont-elles écologiques?" Oui, dit Pollution Probe; Non, dit Greenpeace. "Les couches de coton réduisent les déchets à enfouir, mais leur lavage demande une plus grande dépense d'énergie sans compter le détergent."

1.2.1.5 LA POMME DE TERRE

La Presse, 25 novembre 1989

"Tout ce que nous mangeons contient du poison. La nature crée ses propres agents chimiques; la pomme de terre en contient en moyenne 150."

1.2.1.6 L'ATMOSPHERE

Time Magazine, Novembre 1989 et La Presse, 27 janvier 1990

Selon la théorie GAIA du scientifique Lovelock, le niveau d'oxygène est demeuré stable dans l'atmosphère depuis 200 millions d'années stabilisant ainsi la température, ceci par une fonction d'ajustement entre la terre et les autres planètes. Le World Watch Institute déclarait le contraire "la composition chimique de l'atmosphère est très différente de ce qu'elle était il y a à peine 150 ans".

1.2.1.7 ADDITIF ALAR SUR LES POMMES

Time Magazine, Décembre 1989

Selon Bruce Ames, un biologiste de l'Université de Californie, le produit Alar, décrit par plusieurs comme toxique, est moins dommageable que plusieurs fruits qui, sans additifs, contiennent 1,000 fois plus d'éléments carcinogènes.

Il apparait évident que les media peuvent avoir un rôle important d'information et les gouvernements et entreprises qui oeuvrent constamment avec les divers publics devront tenir compte de cette réalité.

CETTE OMNIPRÉSENCE DES MEDIA PEUT EXPLIQUER COMMENT LE NIMBY PEUT RAPIDEMENT DEVENIR UN SUJET PUBLIC. EN EFFET, LES PRÉOCCUPATIONS AU SUJET DE L'IMPLANTATION D'UN ÉQUIPEMENT PASSENT RAPIDEMENT DE QUELQUES CITOYENS A TOUTE LA COMMUNAUTÉ LOCALE. DE LA, LE SUJET EN QUESTION N'A PLUS DE FRONTIERE. DANS UN TEL CONTEXTE, LA COMMUNAUTÉ EST POINTÉE DU DOIGT PUBLIQUEMENT COMME L'ONT ÉTÉ SENNETERRE, SAINT-BASILE, L'ANGLETERRE ET BAIE-COMEAU DANS LE CAS DES BPC.

1.2.2 DÉMOCRATISATION POLITIQUE

Un deuxième impact important de la SOCIÉTÉ D'INFORMATION se manifeste au niveau politique. Selon Marshall McLuhan, l'ère électronique nous implique malgré nous dans de grands phénomènes sociaux. La nouvelle société est décentralisée en terme de forces politiques mais reliée par l'information. Toffler et Naisbit, tous deux, s'accordent à dire qu'une des plus grandes conséquences de la SOCIÉTÉ D'INFORMATION est la décentralisation du pouvoir politique. Le pouvoir est partagé avec des groupes d'intérêts minoritaires mais très actifs, dont le système électoral est dépassé par des activités de représentation et d'échanges entre les périodes électorales. Aux États-Unis, 25 % des citoyens appartiennent à des groupes participant au processus de décision politique(7). Soucy D. Gagné, de SORECOM, déclarait récemment que l'opinion publique est devenue une force consciente d'elle-même et peut, grâce aux media, faire des choix stratégiques(8). Léon Dion, politicologue bien connu, énonçait cette hypothèse depuis déjà quelques années.

Il faut donc modifier notre compréhension du système politique et élaborer des façons de faire qui en tiennent compte.

LE NIMBY, CONSTATÉ DANS LE MOUVEMENT D'OPPOSITION A L'IMPLANTATION D'UN CENTRE DE TRAITEMENT DES RÉSIDUS INDUSTRIELS A SOUTH CAYOUGA

EN ONTARIO ÉTAIT, SELON UN SPÉCIALISTE A LA CONFÉRENCE SUR LE NIMBY A YORK UNIVERSITY EN 1984, DU A L'ABSENCE DE DÉMOCRATIE DES ÉLUS ET DES FONCTIONNAIRES DANS LE PROCESSUS. LA LITTÉRATURE ABONDE DE CAS OU LES ÉCHECS D'IMPLANTATION SONT DUS A L'ABSENCE D'IMPLICATION DES CITOYENS ET GROUPES, TOT DANS L'IMPLANTATION. L'engagement des élus, leur transparence et leur présence sont des éléments importants pour établir une confiance entre la population et eux. Dans le cas où le NIMBY a été contré, les élus ont joué un rôle primordial pour rendre crédible les projets des administrations publiques et privées. Le citoyen d'aujourd'hui, plus scolarisé et plus informé, souhaite participer au processus décisionnel lorsqu'il se sent directement touché.

Nous verrons dans les solutions proposées comment innover sur le plan des structures politiques et comment modifier nos attitudes pour sérieusement s'attaquer au NIMBY.

1.2.3 COMPLEXITÉ DES ADMINISTRATIONS PUBLIQUES

S'il y a décentralisation effective du système politique, les administrations publiques sont aussi affectées par ses mouvements de la base, de densification des populations et interaction des systèmes sociaux. L'adaptation est plus difficile compte tenu de la complexité et la taille des administrations publiques. L'urbanisation et les échanges ont nécessité des interventions de l'état en terme de lois et réglementations. Selon des études, les informations techniques sont plus facilement diffusées que les informations sur les lois et règlements(9). Il semblerait que les institutions conçues pour un rythme plus lent sont incapables de décider aussi rapidement que l'exigent les événements. Un exemple peut illustrer les difficultés des administrations publiques à gérer des problèmes reliés à l'environnement: après que GM eut dépensé 800 millions $ pour se conformer aux normes gouvernementales, le gouvernement annonce que les voitures ainsi équipées émettent 35 fois plus d'acide sulfurique qu'avant(10).

Le cas de l'amiante où des études récentes faites par des experts américains concluaient à l'absence de risque est illustrateur à cet égard. Les normes vont représenter des coûts énormes à la société tant que les législations ne seront pas changées. La revue Time du 29 janvier 1990 nous indiquait que le risque de mourir par la cigarette, la noyade ou en jouant au football est 100 à 1,000 fois plus élévé que d'être exposé à l'amiante dans un édifice.

Le grand spécialiste de l'administration américaine, Yehezkel Dror, déclare que les administrations publiques doivent aujourd'hui gérer des situations beaucoup plus complexes résultant d'une accélération technologique et d'une évolution sociale rapide. Il propose une plus forte participation des citoyens, une présence du monde universitaire, un enrichissement des responsabilités des fonctionnaires et une propension à l'action(11).

LE NIMBY RÉSULTE SOUVENT D'ABSENCE DE PROCESSUS OUVERT ET ADÉQUAT DE SÉLECTION DE SITE, DE PARTICIPATION DES CITOYENS DANS L'ÉLABORATION DES DEVIS D'ÉTUDES D'IMPACT ET DANS LA RÉALISATION DES ÉTUDES. DES IMPROVISATIONS ONT SOUVENT CAUSÉ DES DIFFICULTÉS DE LOCALISATION D'ÉQUIPEMENTS DANS DES PARCS INDUSTRIELS. CES PARCS ÉTAIENT INAPPROPRIÉS ET N'AVAIENT AUCUN ACCES ROUTIER CONVENABLE.

ON A SOUVENT VOULU IMPOSER A UNE COMMUNAUTÉ LA RESPONSABILITÉ DE SUPPORTER SEULE DES ÉQUIPEMENTS RÉGIONAUX SANS ASSURER DES MESURES DE MITIGATION ET DE COMPENSATION ACCEPTABLES.

1.2.3.1 CONTRIBUTION DU MONDE SCIENTIFIQUE

L'absence du monde scientifique pour donner un éclairage aux divers intervenants impliqués dans nos processus sociaux est une cause importante du développement du NIMBY. Une des grandes craintes des citoyens repose sur l'imprécision des évaluations des procédés, des techniques, de leurs impacts et des risques.

Selon le Dr. Francis M. Gaddis de Columbia University, qui a effectué une recherche importante sur les critères de sélection, une des deux principales recommandations concerne le monde scientifique: "A call to the scientific community to become more involved in the decision making processes and collectively provide support through their professional societies and academic institutions for the exercise of their societal responsibilities"[12].

Selon Desmond M. Connor, spécialiste en concertation sociale, l'Université de Toronto a joué un rôle important pour dédramatiser la question des BPC dans la région de Toronto.

Selon Paul Slovic[13] dans la revue Science, Vol. 236, 17 avril 1987, les craintes sont déterminées par la non compréhension de la situation. Un accident de train inspire moins de crainte qu'un laboratoire de recherches sur l'ADN qui apparait comme mystérieux.

Il cite le scientiste A. Wildawsky qui indiquait qu'il y a aujourd'hui plus de risques au sujet d'une forte quantité d'anciens petits barrages que des réacteurs nucléaires. Or, les citoyens s'opposent fortement au nucléaire mais ne s'inquiètent pas des barrages.

Il ajoute que les études sont aussi assez éloquentes sur la perception des risques: plus les personnes sont formées scientifiquement, moins ils perçoivent comme dangereux divers éléments perçus comme à risque dans la population.

Slovic ajoute qu'une étude indique que les gens acceptent facilement les risques de faire du ski, 1,000 fois plus dangereux, que les préservatifs dans la nourriture et qu'il est autant dangereux de conduire sur une distance de trois milles que d'habiter à côté d'une centrale nucléaire.

La revue Time, qui couvrait l'incident des raisins du Chili, indiquait que les experts déclaraient qu'il était beaucoup plus risqué d'être frappé par une voiture en se rendant au centre d'achats pour acheter ces raisins que de les manger.

Finalement, Henry. I. Balker, directeur de la recherche à l'Institut canadien des pâtes et papiers, déclarait récemment que l'ignorance de la science résulte en soupçons et peurs[14].

La contribution du monde scientifique peut se manifester de diverses façons. Premièrement, comme expertise neutre et objective à laquelle peuvent faire appel les gouvernements, les media, les groupes écologiques, les entreprises et les citoyens. L'inquiétude des citoyens, dans l'implantation des usines des eaux usées, attribuée à un manque d'information scientifique, s'est modifiée suite à des ateliers de travail auxquels participaient médecins, toxicologues, ingénieurs et chimistes.

UNE DES GRANDES CAUSES DU NIMBY REPRÉSENTÉE PAR DES SENTIMENTS DE CRAINTE ET D'INQUIÉTUDE EST ATTRIBUABLE AUX DIFFICULTÉS QU'ONT LES MEDIA ET LA POPULATION A OBTENIR DES INFORMATIONS CLAIRES ET SIMPLES POUR LES GUIDER DANS LEURS ÉVALUATIONS DU RISQUE ET COMPRÉHENSION DES ÉLÉMENTS DES PROJETS.

1.2.4 L'IMPUTABILITÉ SOCIALE DES ENTREPRISES PRIVÉES

En 1990, le terme "privé" n'est plus adéquat pour décrire l'entreprise privée car aujourd'hui, aucune activité économique ou commerciale ne peut être vraiment privée.

La SOCIÉTÉ D'INFORMATION amène aussi des changements dans le fonctionnement des entreprises privées. Une cause majeure dans l'implantation de projets est la crédibilité des entreprises. Le citoyen, au départ, ne fait pas confiance à l'entreprise et souvent, refuse l'échange avec ses représentants.

Gerald Clay de l'entreprise Star-Kist admet que lors de l'événement du poisson avarié, il eut été préférable de s'ouvrir à la population.

Johnson & Johnson, lors de la crise Tylenol, procédait d'une façon tout à fait différente et réussissait à récupérer leur marché(15).

LA NÉGLIGENCE DE CERTAINES ENTREPRISES DE BIEN PRÉSENTER LEUR PROJET, D'UTILISER UNE TECHNOLOGIE ÉPROUVÉE, D'ETRE DISPONIBLE POUR LES GOUVERNEMENTS, LES MEDIA, LES GROUPES ET LES CITOYENS A SOUVENT CRÉÉ DES NIMBY. QUI ACCEPTERAIT, DANS SA COUR, LES CONDITIONS MÉDIOCRES D'ENTREPOSAGE DE BPC?

1.3 LE CAS DES BPC

Je n'analyse pas ici la période reliée directement au NIMBY à Senneterre. Mon collègue Alain Sauriol est mieux placé pour le faire. Mon analyse porte sur quelques mois avant les élections provinciales du 25 septembre 1989, pendant les élections et quelques mois après.

1.3.1 AVANT LES ÉLECTIONS

Il est intéressant de noter que du 4 octobre 1988 au 16 juin 1989, des BPC ont voyagé au Québec et du Québec en Angleterre, sans problème majeur.

La Presse, 4 oct. 88	"11,000 litres de BPC du Nouveau-Brunswick arrivent à Montréal".
La Presse, 8 juin 89	"110 tonnes de BPC expédiées en Angleterre le 1er juin 1989".
La Presse, 8 juin 89	"215 tonnes de BPC expédiées en Angleterre".
La Presse, 16 juin 89	"Hydro-Québec expédie 120 tonnes de BPC en Grande-Bretagne". Dans cet article, on rapporte que les employés du port s'étonnent de l'intérêt porté aux BPC par les media. Ils estiment que des matières beaucoup plus dangereuses sont manipulées tous les jours dans le port, sans qu'on y prête attention.
La Presse, 19 juin 89	"L'UPA et les centrales syndicales déboursent 40 000 $ pour contrer l'incinérateur des BPC".

Jusqu'au 16 juin 1989, le NIMBY en Angleterre n'existait pas pour les BPC du Québec. Qu'est-il arrivé pour que l'Angleterre et Baie-Comeau utilisent le NIMBY pour refuser les BPC du Québec?

1.3.2 PENDANT LES ÉLECTIONS

Posons-nous les questions suivantes:

S'il n'y avait pas eu de téléphone, ni de télévision entre l'Angleterre et le Québec, un mouvement d'opposition se serait-il développé si rapidement?

S'il n'y avait pas eu d'élection, aurait-on acheminé les BPC de Saint-Basile en Angleterre après leur refus en Alberta?

Si les BPC n'avaient pas déjà été refusés à Senneterre et perçus dans l'opinion publique comme un produit dangereux et non bienvenue, les Anglais se seraient-ils sentis humiliés, dévalorisés à la face du monde?

On peut ~~se poser~~ la ~~même~~ ~~ques~~tion pour les gens de Baie-Comeau.

À la première question, il est évident que la rapidité de communication facilite le développement d'un mouvement d'opinion publique. La Presse, le 11 août 1989, titrait "Greenpeace continue le combat", déclarait un porte-parole de Greenpeace rejoint à Londres par La Presse.

La partisanerie politique a aussi augmenté la couverture médiatique des BPC. Alain Dubuc de La Presse déclarait, le 31 août 1989, "que la question des BPC avait monopolisé la campagne électorale". De toute évidence, les Anglais se sont vus dévalorisés. Leurs journaux titraient "nous ne voulons pas être la poubelle du monde". Il aurait été plus approprié pour nous de mener une campagne dynamique d'information et lancer un message international louangeant les Anglais pour leur avance technologique et leur capacité de traiter les BPC de façon sécuritaire. Le sentiment de dévaluation aurait pu être atténué.

Pour les gens de Baie-Comeau, même si la responsable de la coalition contre l'entreposage à Baie-Comeau déclarait que pour eux, les conteneurs étaient sécuritaires, c'était, selon elle, la façon dont on avait imposé cette décision, donc le processus, auquel on s'objectait.

A la dernière question au sujet d'une absence d'information scientifique comme cause du NIMBY, il faut croire que le 15 août 1989, au début de la fièvre électorale, l'article de Louis-Gilles Francoeur était écrit trop tard. "Les BPC de Saint-Basile sont inoffensifs. La crainte politique l'a emportée sur le bon sens et la raison, affirment les spécialistes". De même que les éditoriaux dédramatisants de La Presse, du Soleil, du Journal de Montréal à la même période, ils venaient trop tard. Plus particulièrement, le 8 septembre 1989, Le Devoir rapportait "Le gouvernement a amplifié le danger et aidé à créer la psychose, selon les chimistes". Ce témoignage vital pour la population aurait été beaucoup plus bénéfique un an auparavant. Le 8 septembre, nous avions atteint un point de non retour.

La notoriété de l'événement a particulièrement atteint son paroxisme au niveau des media lorsque le 24 août 1989, La Presse avait, dans une seule parution, six (6) articles sur les BPC, dont la manchette en première page:

i. "Baie-Comeau mobilise ses citoyens".
ii. "Les BPC à Manic 2: Mulroney endosse la décision de Québec".
iii. "BPC: Bourassa accuse Parizeau de fraude intellectuelle".
iv. "Un employé chargé du nettoyage des BPC est gravement blessé".
v. "Les BPC de Saint-Basile: le gouvernement accusé de se défiler".
vi. "Les BPC font route vers Baie-Comeau".

1.3.3 APRES LES ÉLECTIONS

Après la campagne électorale et le débarquement à Baie-Comeau, le calme revient.

La Presse, 17 nov. 89	"28 barils de BPC ont quitté Montréal pour la France. Aucune opposition en France".
La Presse, 23 nov. 89	"La cargaison est arrivée sans encombre et dans l'indifférence des media et des organisations écologiques".

Pourquoi les mêmes BPC n'ont pas créé de NIMBY en France? On peut faire l'hypothèse que le sujet avait perdu son intérêt, que l'acheminement n'était plus politisé et qu'il ne pouvait devenir sujet important de discussions publiques.

De la même façon, La Presse nous informait, le 17 septembre 1989, "Des BPC voguent sans histoire". "Un chaland chargé de 400 tonnes de BPC est arrivé hier à Goose-Bay sans, toutefois, donner lieu à des protestations comme cela avait été le cas lors de l'arrivée de cargaison similaire à Baie-Comeau".

On pourrait faire l'hypothèse que l'isolation de Goose-Bay et l'absence d'activités politiques intenses chez eux à cette période sont des facteurs qui ont empêché le développement du NIMBY.

Sans aucun doute, nous avons ici plusieurs bons sujets de thèse en sciences politiques, communications, journalisme, administration publique, etc...

1.4 SOLUTIONS

1.4.1 LES CONDITIONS PRÉALABLES

- DES ÉQUIPEMENTS ET PROCÉDÉS SÉCURITAIRES SANS NUISANCE DE TOUT ORDRE: VISUELLE, D'ODEUR, DE BRUIT, DE TRANSPORT ET DE CONTAMINA-

TION AIR, EAU, SOL.

- DES ENTREPRISES QUI ACCEPTENT LES NOUVELLES REGLES DE FONCTIONNEMENT DE LA SOCIÉTÉ D'INFORMATION QUANT A LEUR OUVERTURE.
- DES CRITERES DE SÉLECTION DE SITES VALIDÉS AUPRES DES COMMUNAUTÉS VISÉES.
- DES MEDIA QUI RECHERCHENT UNE OBJECTIVITÉ MALGRÉ LEUR DOUBLE ROLE CARACTÉRISÉ PAR LA NÉCESSITÉ DE DONNER DE L'INFORMATION ET EN MEME TEMPS, DE FAIRE DES AFFAIRES.
- DES SITES QUI RESPECTENT UN ÉQUILIBRE ENTRE LE PRINCIPE QUE CHACUN DOIT ASSUMER SES RESPONSABILITÉS SOCIALES DANS LE TRAITEMENT DES DÉCHETS ET CELUI QUE LES FACTEURS ÉCONOMIQUES, TECHNIQUES ET DE SÉCURITÉ DOIVENT DÉTERMINER LA TAILLE DES ÉQUIPEMENTS DE TRAITEMENT.
- DES ADMINISTRATIONS PUBLIQUES ET DES ENTREPRISES QUI ACCEPTENT QUE LE SYSTEME POLITIQUE D'AUJOURD'HUI EST CARACTÉRISÉ PAR UNE DÉMOCRATIE PLUS INTENSE DÉPASSANT LE VOTE PÉRIODIQUE.
- DES SCIENTIFIQUES QUI S'IMPLIQUENT A TOUS LES NIVEAUX.
- DES PHILOSOPHIES ET VALEURS ORIENTÉES VERS LA MÉDIATION ET LE COMPROMIS ET NON LA CONFRONTATION.
- DES ADMINISTRATIONS PUBLIQUES ET PRIVÉES PROACTIVES.
- DES ÉLUS AVEC VISION ET LEADERSHIP.

Une recherche m'a permis d'identifier en Europe, aux États-Unis et au Canada, des cas succès où le NIMBY a été bien géré. J'ai retouvé dans chacun des cas à succès les mêmes principes et méthodes. Je vous les livre:

1.4.2 CAS A SUCCES

a) L'implantation d'un centre de traitement intégré des déchets, le Gulf Coast Waste Disposal Authority's Facility, au Texas

Selon le Dr. M. Francis Gaddis, les deux principales stratégies utilisées sont: Implication des media et Implication du milieu comprenant le monde scientifique, la Chambre de Commerce et les groupes communautaires locaux dans un processus de planification publique, le Texas Keystone Plan(16).

b) L'implantation d'un centre de traitements dans la petite ville de Nyborg au Danemark

Selon la revue Waste and Pollution Control, les éléments de succès sont: collaboration gouvernementale et secteur privé avec retombées économiques en attirant de nouvelles industries dans le parc industriel pour profiter de ces équipements de dépollution; et participation de tous les intervenants du milieu(17).

c) Relocalisation, en 1982, d'un hameau de la communauté rurale de Keephills située à 80 kilomètres d'Edmonton dans l'implantation d'une centrale thermique utilisant le charbon de la mine Highvale. Ceci, après qu'un autre site avait été refusé suite à l'opposition des citoyens en 1976.

Selon le directeur du projet de TransAlta Utilities Corporation, les éléments du succès furent:

i. philosophie de participation du public;
ii. étape initiale d'information complète sur les règles du jeu au tout début du projet;
iii. établissement de rapports crédibles et authentiques avec la communauté avant de procéder;
iv. connaissance des attentes, préoccupations et dimensions culturelles de la communauté;
v. comité de coordination et de liaison avec la communauté, formé de sept personnes: trois de la communauté, deux de TransAlta et deux de la MRC.

En plus, six fonctionnaires assistaient aux réunions du comité comme aviseurs techniques;

vi. utilisation de médiateurs "conflict managers".

Selon le directeur, ce processus, quoique coûteux et long, maintient la confiance du public envers le gouvernement et les entreprises et assure l'implantation du projet(18).

d) Remplissage d'une carrière située sur l'Ile Shady près d'un village de pêcheurs, Steveston, Colombie-Britannique

Une forte opposition et la présence de 12 groupes d'intérêts impliqués dans un processus de participation publique acceptent finalement un plan proposé par un représentant des citoyens.

Selon Desmond M. Connor, consultant dans ce projet, les éléments à succès furent:

i. une bonne identification des préoccupations réelles des citoyens;
ii. l'établissement de liens avec les divers publics: citoyens, syndicats, divers paliers de gouvernements;
iii. de bons dossiers techniques sur les enjeux du projet;
iv. un plan de communication et de consultation vulgarisant les informations techniques;
v. une gestion de projet crédible, proactive, disponible et transparente(19).

e) L'implantation d'un centre intégré de traitement de résidus industriels par un comité mixte gouvernement/entreprise privée à Swann Hills en Alberta en 1986

Selon un responsable de Chem-Security qui opère le centre, M. John Richardson, et selon la consultante impliquée dans le projet, les éléments à succès furent:

i. création d'un comité de liaison avec les citoyens;
ii. plan d'information complet avec toutes les données pertinentes, objectifs, moyens, etc...;
iii. étroite collaboration avec les administrations publiques;
iv. remise systématique des informations aux media(20).

f) L'implantation d'un centre de traitement de résidus industriels inorganiques à Blainville, en 1983, par l'entreprise Stablex Canada Limitée

Une pétition de 6,000 personnes contre le projet s'est transformée graduellement en une opposition très réduite laissant dire aux media "l'ouverture de Stablex, une fête écologique".

Les éléments à succès furent:

i. l'utilisation de critères de sélection adéquats;
ii. volonté politique forte des trois paliers de gouvernement;
iii. la présence sur le terrain, à Blainville, des fonctionnaires;
iv. une philosophie de transparence, de disponibilité et d'ouverture de la part de Stablex et des gouvernements;
v. des études complètes pour répondre aux préoccupations des citoyens, ex: la glaise, le transport;
vi. la formation d'un comité de liaison avec trois citoyens nommés par les groupes communautaires;
vii. une visite d'un centre similaire par les gouvernements, les media, les citoyens;
viii. plusieurs rencontres d'information avec les media;
ix. présence d'une équipe gouvernement/entreprise lors de colloques scientifiques, kiosques publics, lignes ouvertes, variété de réunions formelles et informelles (environ 50);
x. des mesures de mitigation adéquates comme un accès à l'autoroute pour le transport des camions et en même temps, donnant une mesure de compensation en facilitant l'accès des résidents à l'autoroute. Aussi, les contributions gouvernementales pour faciliter la création d'un parc industriel;

xi. l'exercice d'un rôle proactif de la part du promoteur, de la municipalité et du gouvernement provincial. Laissons le maire de Blainville parler "au début, nous étions plutôt rébarbatifs à l'idée de l'implantation de l'usine Stablex dans notre localité. Cependant, après s'être informés plus en profondeur et avoir effectué un voyage en Angleterre, nous avons rapidement modifié notre impression. Un comité de citoyens a été formé pour suivre le dossier. Stablex a fortement contribué au développement industriel et domiciliaire. De plus, je vous ferai remarquer que l'un des plus grands projets domiciliaires est situé juste à côté de l'entreprise. J'ai été réélu par acclamation au scrutin suivant de peu l'arrivée de Stablex"(21).

1.4.3 PRINCIPES DIRECTEURS

Résumons les principes directeurs identifiés par plusieurs spécialistes à travers le monde:

a)	Utilisation de critères de sélection - adéquats	- Carolyn Konheim, consultante en environnement de Brooklyn, N.Y. - Dr. M. Francis Gaddis (op. cit.)
b)	L'implication des citoyens dans l'étude d'impact	- Carolyn Konheim (op. cit.) - International Institute for Environment and Society of the Science Center of Berlin (op. cit.)- - Desmond M. Connor (op. cit.)
c)	Attitude proactive et transparence des promoteurs	- Joyce Young, consultante en consultation et médiation - Garry J. Prokop, TransAlta (op. cit.)
d)	Eviter la confrontation à tout prix	- Desmond M. Connor - Joyce Young - Planning Review, Michael M. Klepper
e)	Recherche d'un win-win	- Joyce Young
f)	Rencontre informelle avec les divers publics pour compléter le processus d'information et de consultation des audiences publiques	- Joyce Young - Garry J. Prokop, - Dr. M. Francis Gaddis
g)	Participation du public tôt dans le projet	- Joyce Young - Science Center of Berlin - Dr. M. Francis Gaddis - Carolyn Konheim - Joe Haworth, L.A. County Sanitation Districts - Garry J. Prokop
h)	Visite d'installations identiques	- Carolyn Konheim
i)	Implication du monde scientifique	- Présidente du Comité de citoyens Ste-Foy, Suzanne Drouin - Dr. M. Francis Gaddis - Yehezkel Dror
j)	Connaissance de la communauté, des préoccupations et enjeux avant de démarrer le projet	- Desmond M. Connor - Garry J. Prokop - Carolyn Konheim

k) Formation d'un comité de liaison avec les citoyens
- John Richardson, Chem-Security
- Pierre Grenier, Stablex Canada
- Desmond M. Connor
- Garry J. Prokop.

Je me suis borné à faire une liste des principes directeurs et n'ai pas traité, dans le présent texte, de méthodologie détaillée. Cela pourrait représenter un sujet intéressant pour un futur colloque. Chronologiquement, il est capital de commencer par des changements d'attitudes et de comportements avant de procéder à l'opérationnalisation des principes directeurs.

CONCLUSION

Tout intervenant, qu'il soit ministre, fonctionnaire, chef d'entreprise, professeur d'université, citoyen ou journaliste, doit comprendre son rôle dans une société intégrée par les communications et retenir ce que Marshall McLuhan disait "à la rapidité que l'information circule et augmente en intensité, les systèmes politiques ont tendance à s'éloigner d'un système de délégation et représentation à un système d'implication spontanée et immédiate de l'ensemble de la communauté dans le processus de décision publique(22). A date, les processus d'implantation sont conflictuels, coûteux, longs et ne réussissent pas souvent. J'en propose un qui est aussi long et coûteux mais qui peut être relativement harmonieux et vous assure qu'un projet ne sera pas abandonné.

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A CASE STUDY OF "NIMBY SYNDROME" IN OCEAN DUMPING IN SAMBRO HEAD, NOVA SCOTIA, CANADA IN 1989

By

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Environmental Protection
Conservation and Protection
Environment Canada
Atlantic Region

Ocean dumping is controlled in Canada under Part VI of the Canadian Environmental Protection Act. During the fall of 1989, the Canadian Department of Public Works was granted a permit to ocean dispose of [illegible]15,000 cubic metres of relatively clean dredge spoil at a protected, shallow water dump site adjacent to the village of Sambro Head, near Halifax, Nova Scotia, Canada. The dredge spoil originated from a number of small channel deepening projects in the nearby village of Sambro.

Despite the absence of significant contamination, any appreciable resources at risk and any appreciable aesthetic degradation and the presence of an historical dump site at the permitted site, a successful media campaign was mounted by Sambro Head citizens to have the dredging stopped and a new dump site selected. Cost overruns on the dredging project, directly attributable to the delays associated with suspension and change of the dump site, amounted to approximately $100,000.

This paper will present a description of the process used in selecting the original dump site and the associated physical and biological environment, activities associated with the dredging and ocean dumping operation and a chronology of actions taken by Sambro Head citizens in their successful bid to have the project suspended and the dump site re-located. Finally, an evaluation of tactics used by the citizens will be presented and recommendations on avoiding similar incidents in the future will be made.

EFFECT OF SEWAGE DISCHARGE FROM PLEASURE CRAFT ON MARINE WATER AND SHELLFISH QUALITY

by

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INTRODUCTION

As recreational boating continues to expand worldwide, it is not surprising that environmental problems have developed in small embayments crowded with recreational watercraft. The indiscriminate discharge of raw or inadequately treated sewage wastes from boats creates a serious public health threat, is visually and aesthetically repulsive, and constitutes an environmental insult.

PUBLIC HEALTH CONCERN

The discharge of raw sewage from watercraft has the serious potential of introducing disease-causing organisms into the marine environment. If sewage is discharged near shellfish-growing areas the shellfish, which are filter feeders, tend to concentrate the organisms within their intestinal tract. Then, if shellfish are eaten by humans, there is an undeniable relationship between the ingestion of raw or inadequately cooked, contaminated shellfish and intestinal disorders. Likewise, although it is difficult to substantiate, there is a potential health threat to those who engage in contact sports in contaminated waters.

The most notable diseases which have the potential of being transmitted by the so-called "fecal-oral route" are typhoid fever, dysentery, infectious hepatitis, and nonspecific gastroenteritis. Figure 1 illustrates the potential for disease transmission that exists when untreated sewage is discharged from boats into embayments or marinas.

Thus, the pollutional effect of boat waste discharges into small, quiescent, poorly flushed embayments or marinas is viewed by public health professionals as being a serious problem. On the other hand, that a health threat even exists is often denied by the boating community or is simply looked upon as being insignificant.

ENVIRONMENTAL IMPACT

In addition to a concern for public health, the improper discharge of sewage from watercraft may be an environmental insult as well as an

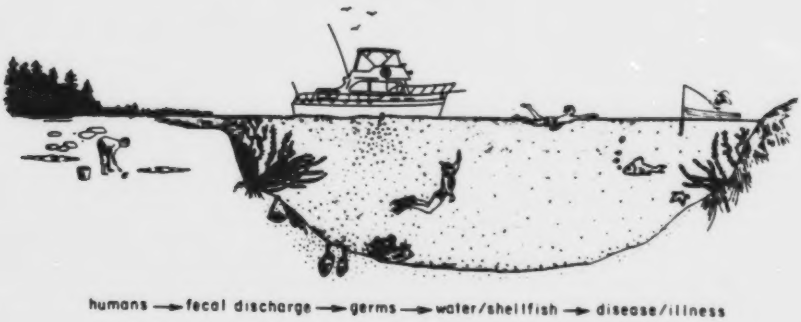

humans → fecal discharge → germs → water/shellfish → disease/illness

Figure 1. Route of Potential Disease Transmission from Boat Waste Discharges

affront to one's senses. In certain extreme situations the discharge of sewage from large numbers of pleasure craft into an embayment or a marina can despoil the waters to such an extent that the natural amenities which attracted the boaters in the first place will no longer exist.

WATERCRAFT POLLUTION CONTROL REGULATIONS

In 1972, in response to the water quality problems resulting from sewage waste discharges from watercraft, the U.S. Congress amended the Federal Water Pollution Control Act with the objective of entirely eliminating the direct discharge of untreated sewage from watercraft. As a result of these amendments, the U.S. Environmental Protection Agency (EPA) and the U.S. Coast Guard (USCG) established regulations that require the use of permanently installed marine sanitation devices (MSDs) on boats equipped with marine toilets. Identified as Types I, II, and III, the MSDs are designed either to treat sewage prior to overboard discharge or to hold the sewage on board for shore-based disposal.

While the intent of the amendments was admirable, it is the contention of the authors that the technology which resulted was ill-conceived and resulted in the installation of ineffective systems that were not appropriate for use on small watercraft.

Figures 2, 3, and 4, on the following pages, illustrate and briefly describe the Types I, II, and III marine sanitation devices (MSDs). Figures 5 and 6 illustrate and describe alternative marine toilets.

TYPE I MARINE SANITATION DEVICE (MACERATOR-CHLORINATOR)

The Type I MSD is a flow-through device consisting of a mechanical shredder that is intended to grind the solid waste matter into very small particles. As a means to reduce the bacteria count, some type of chemical disinfectant is added before the waste is discharged into the receiving waters. See Figure 2.

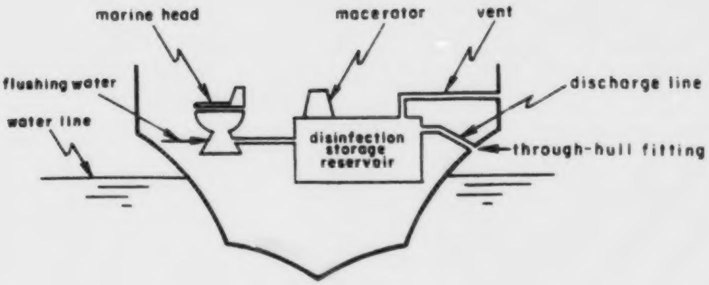
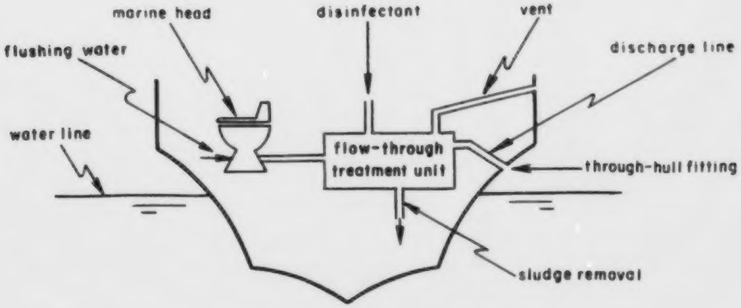

marine head
macerator
vent
flushing water
discharge line
water line
disinfection storage reservoir
through-hull fitting

Figure 2. Type I Marine Sanitation Device (Macerator-Chlorinator)

TYPE II MARINE SANITATION DEVICE (FLOW-THROUGH BIOLOGICAL OR PHYSICAL-CHEMICAL TREATMENT UNIT)

A Type II MSD is a more elaborate flow-through unit which employs additional technologies to produce a higher degree of treatment than is produced by the Type I MSD. The waste matter is shredded, either chemically or biologically treated, and disinfected prior to overboard discharge. Type II MSDs are generally not suitable for use on boats under 65 feet in length. See Figure 3.


marine head
disinfectant
vent
flushing water
discharge line
water line
flow-through treatment unit
through-hull fitting
sludge removal

NOTE: Not appropriate for vessels under 65 feet in length.

Figure 3. Type II Marine Sanitation Device (Flow-Through Biological or Physical-Chemical Treatment Unit)

TYPE III MARINE SANITATION DEVICE (HOLDING TANK)

A Type III MSD consists of a holding tank that is designed to store the waste matter on board a vessel for ultimate onshore disposal. Frequently, disinfectants or deodorants are added to retard decomposition until the tank can be pumped at a shore-based pumpout station. Realistically, it is somewhat of an accepted and necessary practice to discharge the wastes into receiving waters when shore-based pumpout facilities are not available. See Figure 4.

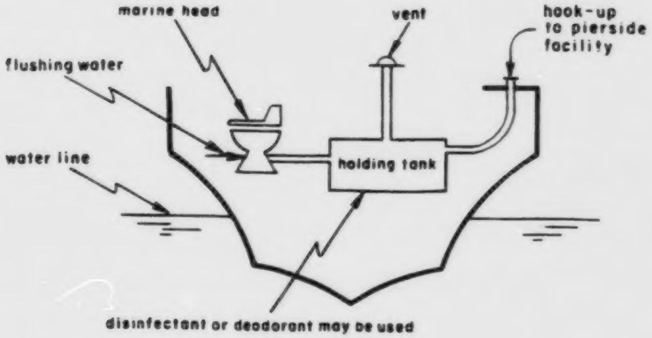

marine head
vent
hook-up to pierside facility
flushing water
water line
holding tank
disinfectant or deodorant may be used

Figure 4. Type III Marine Sanitation Device (Holding Tank)

THROUGH-HULL-FITTING MARINE TOILET

As shown in Figure 5, the old-fashioned marine head has a through-hull fitting that allows direct discharge of untreated wastes into the receiving waters. Quite prevalent on older boats, an estimated 20 percent of the recreational watercraft plying the waters of Puget Sound still have these direct discharge systems even though the law specifically states that vessels with installed toilets must be equipped with MSDs.

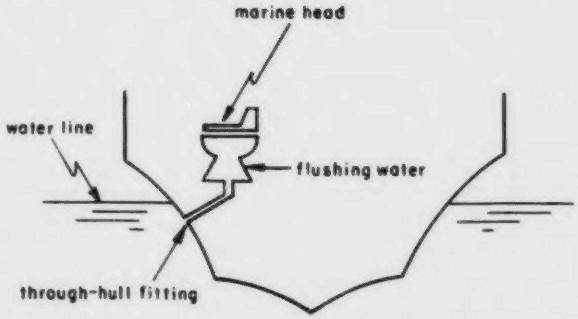

marine head
water line
flushing water
through-hull fitting

Figure 5. Through-Hull-Fitting Marine Toilet

SELF-CONTAINED PORTABLE TOILET

Another common system used on smaller watercraft, as shown in Figure 6, is the portable toilet. These small, self-contained units are capable of storing a limited amount of sewage wastes that later can be carried off the vessel for onshore disposal. The regulations pertaining to MSDs are not applicable to these devices. It is, nonetheless, illegal to dispose of the portable toilet waste contents overboard.

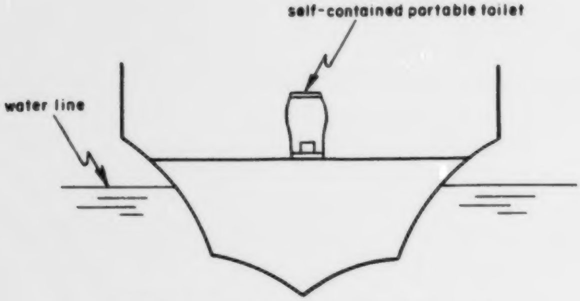


Figure 6. Self-Contained Portable Toilet

THE STUDY

Studies to document the impact of boat wastes on water quality have frequently been confusing and inconclusive. The data presented herein concerns two sites in Puget Sound in the State of Washington that were known to have extensive use by the boating public. The information is part of a two year study by the Washington State Health Department concerning the impact of boat wastes on water and shellfish quality (1).

Located in northwestern Washington, Puget Sound has about 2,350 miles of shoreline and innumerable islands, bays, and inlets which attract extensive pleasure-boat cruising. See Figure 7. Puget Sound is a fjord-like basin with an average depth of 100 m (330 ft) which makes it the deepest and by volume the largest estuarine system in the 48 contiguous states of the United States. A mild climate, light winds, and moderate wave conditions, plus the unparalleled scenic beauty of Puget Sound, combine to make this inland sea a delight to small watercraft operators and recreationalists.

The tidal pattern of Puget Sound is characterized by two highs and two lows daily. The highs and lows are typically at different heights, and the predicted times vary throughout Puget Sound, with a semidiurnal pattern that repeats itself 50 minutes later each successive day. At the northern entrance the mean tide range is 1.5 m (4.9 ft) with a diurnal range of 2.5 m (8.2 ft), while at the southern reaches the mean and diurnal tide ranges are more closely 3.5 and 4.5 m (11.5 and 14.8 ft), respectively. Selection of these two particular sites was based upon their location in the sound, their different flushing characteristics, their relation to shoreside point and nonpoint sources of pollution, and their exposure to varied marine water quality regimens. The two sites that were selected are indicated on the location map, Figure 7, and were:

- Jarrell Cove on Hartstene Island (Mason County)
- Pleasant Harbor (Jefferson County)

A summary of physical and hydrologic characteristics of the study sites is shown in Table 1.

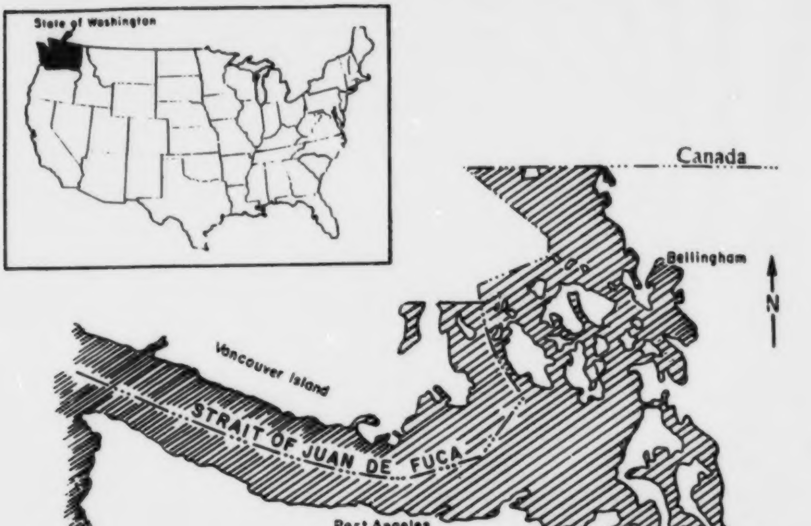

State of Washington
Canada
Bellingham
N
Vancouver Island
STRAIT OF JUAN DE FUCA
Port Angeles
Everett
WASHINGTON
● Indicates study sites
PUGET SOUND
PLEASANT HARBOR
Seattle
PACIFIC OCEAN
JARRELL COVE
Tacoma
Olympia
Aberdeen

Figure 7. Location Map

TABLE 1
STUDY SITES
SUMMARY OF PHYSICAL AND HYDROLOGIC CHARACTERISTICS

Embayment or Marina	Average Tidal Area (Acres)	Average Tidal Depth[1] (ft.)	Average Tidal Volume (ac.ft.)	Mean Depth[2] (ft.)	Average Tidal Prism Ratio[3] (per tidal cycle)
Jarrel Cove	42.7	14.4	615	18	0.80
Pleasant Harbor	40.3	11.6	467	27	0.43

[1] Tidal Prism Reference Stations:
Jarrell Cove (Olympia)
Pleasant Harbor (Seabeck)

[2] Estimates

[3] $$\text{Flushing Rate} = \text{Tidal Prism Ratio} = \frac{(\text{Basin volume at MHHW}) - (\text{Basin volume at MLLW})}{(\text{Basin volume at MHHW})}$$

JARRELL COVE

Site Description

Located on Hartstene Island in Mason County, on one of the southern reaches of Puget Sound, Jarrell Cove was named after the first woman settler on the island. See Figure 7. An aerial photograph is shown in Figure 8, and the water sampling locations are indicated in Figure 9.

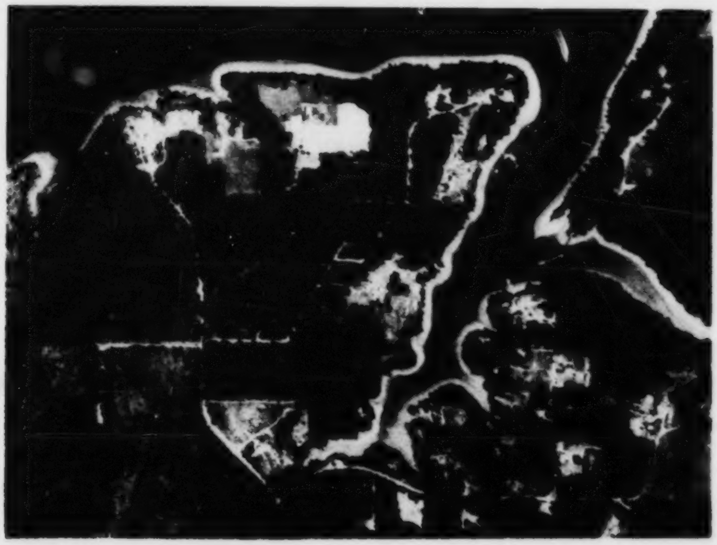
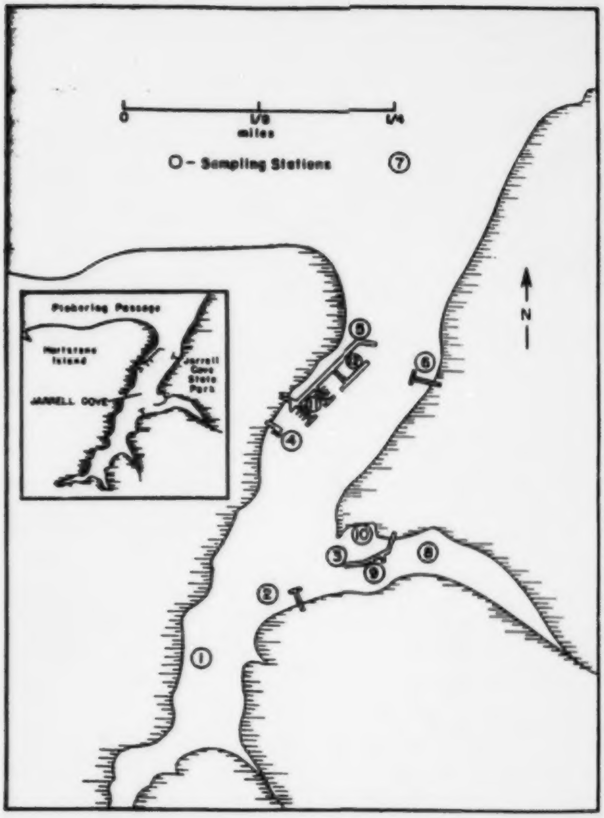


Figure 8. Aerial Photograph of Jarrell Cove


0
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⑧
⑨
②
①
Pickering Passage
Hartstene Island
JARRELL COVE
Jarrell Cove State Park

Figure 9. Jarrell Cove Water Sampling Stations

Jarrell Cove State Park, which features two docks and moorage facilities, as well as picnic areas and a comfort station, is located on the east shore. On the west shore a private marina provides additional boat moorage spaces, a grocery store, apartments,and restroom facilities.

None of the three streams which enters the cove was considered to be a significant source of water pollution. It is worthy of note that the cove has a calculated average water exchange rate of 0.8 per tidal cycle.

Water Quality

Water samples were collected two times each day from 11 stations within Jarrell Cove to define the bacteriological water quality of an area potentially impacted by boating activity and from one station outside the bay to define ambient water quality conditions. As shown in Table 2 and Figure 10, in the month of March, during a period when there was little boating activity, the bacteriological water quality was generally the same inside and outside of the cove and was very low in fecal coliform concentrations (< 1.8 fecal organisms/100 ml).

During the Fourth of July weekend of 1988, a period of intense boating activity, a definite increase in fecal coliform concentration was noted inside the bay, while the count remained essentially the same outside the cove, in Pickering Passage. See Table 2 and Figure 10. Also, with reference to Figure 10 it can be seen that the geometric mean of the fecal coliform density never exceeded the Washington State Department of Ecology Class AA Extraordinary Water Quality Standard of 14 organisms per 100 ml. During that same boating weekend, however, inside the harbor there were individual values on each day in excess of 14 fecal coliforms per 100 ml, while outside the cove correspondingly high values were not found. This increase in fecal coliform counts appears to be the result of boating activity, since all other environmental factors remained unchanged.

TABLE 2

JARRELL COVE WATER QUALITY
FECAL COLIFORMS (ORGANISMS/100 ml)

	Inside[1]			Middle of Bay[2]		
Date	Number of Samples	Range	Geom. Mean	Number of Samples	Range	Geom. Mean
Background:						
3/28/88	18	(<1.8, 20)	<1.8	2	(<1.8, <1.8)	<1.8
3/29/88	18	(<1.8)	<1.8	2	(<1.8, <1.8)	<1.8
Boating Weekend:						
7/1/88	18	(<1.8, 33)	6.5	3	(<1.8, 4.5)	2.4
7/2/88	18	(<1.8, 49)	6.4	2	(<1.8, 2.0)	1.9
7/3/88	18	(<1.8, 49)	4.8	2	(<1.8, <1.8)	1.8
7/4/88	18	(<1.8, 33)	5.9	2	(<1.8, <1.8)	<1.8
7/5/88	18	(<1.8, 17)	4.3	2	(<1.8, 2.0)	1.9

[1] Stations 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, and 12
[2] Station 7

The number of boats moored in the bay is outlined in Table 3 and tends to suggest that the greater the number of boats in the cove the higher the fecal coliform concentration.

TABLE 3
JARRELL COVE BOATING ACTIVITY

Date	Number of Boats Moored[1]
Background:	
3/28/88	10
Boating Weekend:	
7/1/88	40
7/2/88	70
7/3/88	85
7/4/88	47
7/5/88	33

[1] Arithmetic mean of morning and afternoon counts.

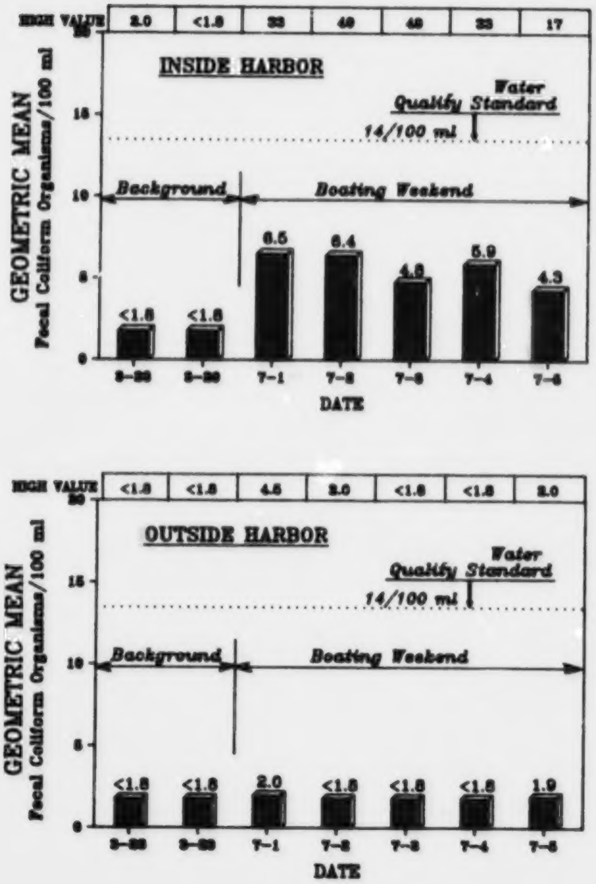


Figure 10. Jarrell Cove Bacteriological Water Quality

Shellfish Quality

Shellfish tissue condition was also used as an indicator of water quality. In Jarrell Cove, eastern softshell, manila, and native littleneck clams were sampled, while outside the cove, in Pickering Passage, only blue mussels were collected, due to lack of availability of other species. Here again the influence of watercraft wastes on water quality was noted. Since shellfish are filter feeders, fecal coliform organisms can be trapped and concentrated in the digestive tract of the shellfish. Those seafood consumers who ingest the entire meat portion of inadequately cooked or raw, contaminated shellfish thereby complete the fecal-oral route of disease transmission.

As shown in Table 4, there was a seasonal increase in total and fecal coliform organisms in shellfish tissue inside the cove, compared to a much smaller increase outside the cove. It can then be postulated that this greater increase was due to boat wastes.

It is of interest that an MPN of < 230 fecal coliform organisms per 100 g is usually considered the shellfish tissue standard for commercial oysters at the wholesale point. As shown in Table 4 this standard was exceeded in 70 percent of the shellfish samples taken from inside the cove during the boating weekend.

TABLE 4
JARRELL COVE SHELLFISH MEAT QUALITY

			Number of Organisms/100 g	
Date	**Location**	**Sample Description**	**Total Coliforms**	**Fecal Coliforms***
Background:				
3/28/88	Outside Cove	Blue Mussels	68	20
3/28/88	Outside Cove	Blue Mussels	130	45
3/29/88	Inside Cove	Eastern Softshells	790	40
Boating Weekend:				
7/1/88	Inside Cove	Native Littlenecks	1,100	1,100
7/1/88	Inside Cove	Native Littlenecks	700	230
7/3/88	Inside Cove	Native Littlenecks	130	78
7/3/88	Inside Cove	Native Littlenecks	3,300	790
7/5/88	Inside Cove	Blue Mussels	2,300	1,300
7/2/88	Inside Cove	Native Littlenecks	1,700	490
7/2/88	Inside Cove	Native Littlenecks	230	230
7/3/88	Inside Cove	Native Littlenecks	230	78
7/4/88	Inside Cove	Native Littlenecks	130	45
7/4/88	Inside Cove	Manilas	1,700	1,100
7/1/88	Outside Cove	Blue Mussels	140	18
7/2/88	Outside Cove	Blue Mussels	330	20
7/3/88	Outside Cove	Blue Mussels	490	45
7/4/88	Outside Cove	Blue Mussels	230	68

* Generally, MPN <230 fecal coliform organisms per 100 g is the commercial shellfish meat standard at the wholesale point.

Discussion

Taken in total, this study revealed that the influence of boat wastes on the water quality of Jarrell Cove was evident. It is entirely possible that the rather large water exchange ratio of 0.80 per tidal cycle effectively flushed the bay and tended to dilute and disperse any contamination introduced by the boats. In addition, it is felt that the cooperation of boaters in minimizing overboard discharges may have reduced the pollution. However, shellfish contamination within the cove exceeded the accepted limit of 230 coliforms per 100 g in 70 percent of the samples. This is further evidence of boat pollution since the blue mussels collected outside of the cove met the standard both during the background study and during a boating weekend.

PLEASANT HARBOR

Site Description

This delightful little harbor on the west shore of Hood Canal, just north of the mouth of the Duckabush River, features a protected, deep-water moorage. Two private marinas are located on the north side, along with the small Pleasant Harbor State Park. Terrestrial runoff around the bay is considered to be of no consequence.

Pleasant Harbor has a very narrow entrance which is a favorite scuba diving area. It has moderate flushing characteristics with a calculated average water exchange rate of 0.43 per tidal cycle. The south shore is completely undeveloped, as shown in the aerial photograph, Figure 11. The location of water sampling sites is shown in Figure 12.

Water Quality

As shown in Figure 12, nine water sampling stations were located inside Pleasant Harbor and three were positioned outside, in Hood Canal. Samples collected during the latter part of March were used to establish the background bacteriological water quality inside and outside the harbor. With reference to Table 5 and Figure 13, it can be seen that at this time the bacteriological water quality was extremely good both inside and outside the harbor. Inside the harbor a slight amount of background bacteriological contamination was detected on two sampling days, as indicated by a geometric mean of 1.9 and 3.2 fecal coliform organisms per 100 ml, respectively.

During the Memorial Day weekend, water samples were collected on five consecutive days. Traditionally, this three-day holiday inaugurates the summer boating season, and Pleasant Harbor is a favorite destination moorage of Puget Sound boaters. A partial summary of boating activity in the harbor is shown in Table 6.

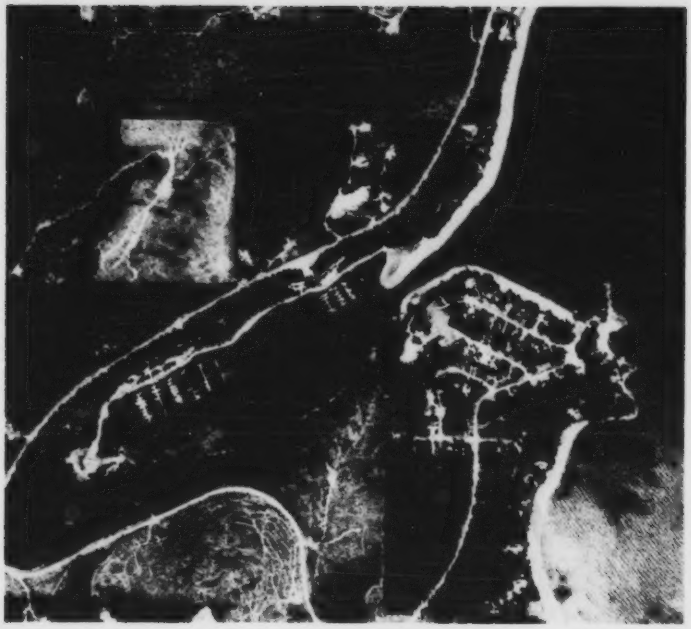
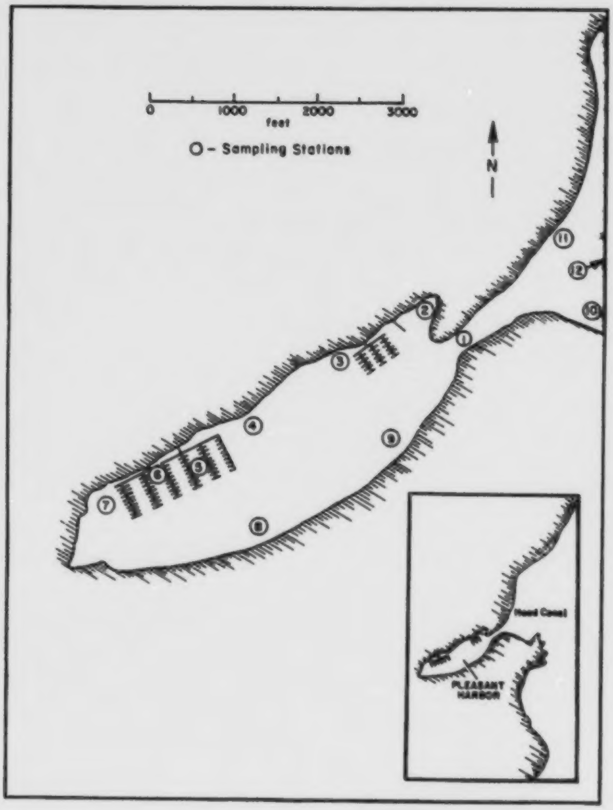


Figure 11. Aerial Photograph of Pleasant Harbor

As shown in Table 5 and Figure 13, there were mixed indications of boat wastes in the harbor. For example, on four of the five days sampled, the geometric mean of the fecal coliform counts for water samples taken inside the harbor exceeded those for samples taken outside, in Hood Canal. In addition, on three days of the five-day boating weekend the water quality inside the harbor failed to meet the Washington State Department of Ecology Class AA Extraordinary Water Quality Standard, while outside the harbor failure to meet the standard occurred on one day only. This elevated cout of fecal coliform organisms outside the harbor may or may not be related to boating activity and is difficult to explain. Nevertheless, these data suggest that the wastes from watercraft had a negative impact on the water quality of Pleasant Harbor since there were no other known sources of contamination.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Hood Canal
PLEASANT HARBOR

Figure 12. Pleasant Harbor Water Sampling Stations

TABLE 5
PLEASANT HARBOR WATER QUALITY FECAL COLIFORMS (ORGANISMS/100 ml)

	Inside[1]			Outside[2]		
Date	Number of Samples	Range	Geom. Mean	Number of Samples	Range	Geom. Mean
Background:						
3/30/88	19	(<1.8, 4.5)	1.9	5	(<1.8, <1.8)	<1.8
3/31/88	17	(<1.8, 79)	3.2	6	(<1.8, <1.8)	<1.8
Boating Weekend:						
5/27/88	21	(<1.8, 540)	15.1	3	(<1.8, 240)	12.0
5/28/88	21	(<1.8, 920)	13.3	3	(<1.8, 4.0)	2.4
5/29/88	21	(<1.8, 350)	8.7	3	(<13, 23)	18.7
5/30/88	21	(<1.8, 79)	4.9	3	(<1.8, 4.5)	2.5
5/31/88	21	(<1.8, 70)	3.0	3	(<1.8, 2.0)	1.9

[1] Stations 1, 2, 3, 4, 5, 6, 7, 8, and 9
[2] Stations 10, 11, and 12

TABLE 6
PLEASANT HARBOR BOATING ACTIVITY

Date	Number of Boats Moored
3/30/88	Not Available
3/31/88	"
5/27/88	"
5/28/88	186
5/29/88	169
5/30/88	Not Available
5/31/88	"

Shellfish Quality

A definite deleterious influence of boat wastes on shellfish tissue meat quality ws noted in Pleasant Harbor. As outlined in Table 8, the baseline non-boating season total and fecal coliform organism counts in shellfish were much lower than during the Memorial Day weekend. In fact, the blue mussels analyzed during that period were found to have a higher degree of contamination than would be expected and, as indicated in Table 7, 91 percent of the results exceeded the accepted commercial standard of < 230 fecal coliforms per 100 g.

TABLE 7
PLEASANT HARBOR SHELLFISH MEAT QUALITY

			Number of Organisms/100 g	
Date	Location	Sample Description	Total Coliforms	Fecal Coliforms*
Background:				
3/29/88	Inside Harbor	Blue Mussels	330	<20
Boating Weekend:				
5/27/88	Inside Harbor	Blue Mussels	7,900	950
5/27/88	Inside Harbor	Blue Mussels	13,000	490
5/27/88	Inside Harbor	Blue Mussels	2,300	790
5/28/88	Inside Harbor	Blue Mussels	3,300	790
5/28/88	Inside Harbor	Blue Mussels	3,300	790
5/28/88	Inside Harbor	Blue Mussels	2,300	490
5/29/88	Inside Harbor	Blue Mussels	1,100	490
5/29/88	Inside Harbor	Blue Mussels	790	230
5/29/88	Inside Harbor	Blue Mussels	7,900	330
5/30/88	Inside Harbor	Blue Mussels	22,000	22,000
5/31/88	Inside Harbor	Blue Mussels	4,600	110

*Generally, MPN <230 fecal coliform organisms per 100g is the commercial shellfish meat standard at the wholesale point.

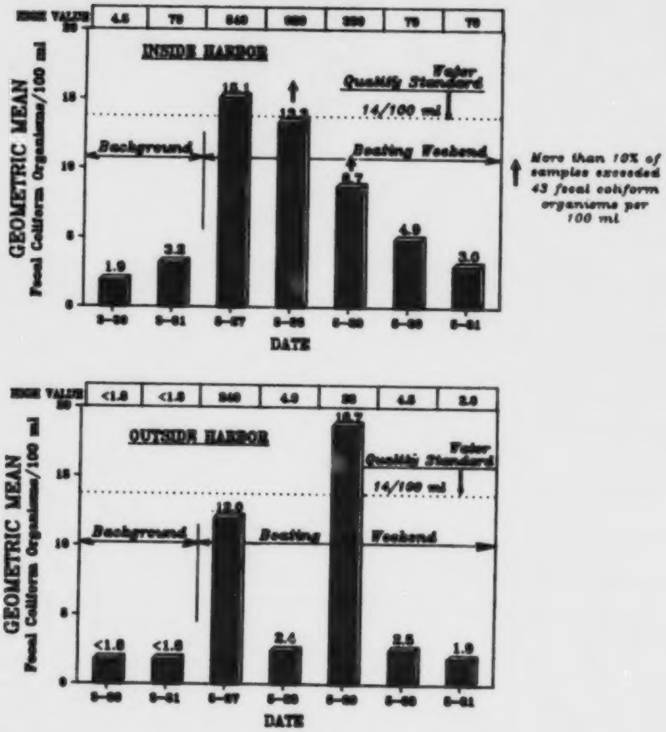

Figure 13. Pleasant Harbor Bacteriological Water Quality

Discussion

The analysis of data accumulated at Pleasant Harbor revealed somewhat mixed results in terms of the influence of boat wastes on water quality. There was an observed increase in fecal coliform counts both inside and outside the harbor during the Memorial Day weekend as contrasted to the background data taken in March of 1988. A deterioration in water quality attributable to boat wastes was suggested by the fact that the fecal coliform concentration inside the harbor failed to meet the Washington State Department of Ecology Class AA Extraordinary Water Quality Standard on three days of the boating weekend, while outside it failed on one day.

Shellfish meat tissue was clearly adversely affected by a source of fecal contamination, with 91 percent of the samples collected exceeding the shellfish industry meat standard. This implies that the source of the fecal organisms may have been from boat wastes since there were no other known sources of contamination going into the harbor.

CONCLUSIONS

The data from this study, when taken in total, demonstrated an impact of watercraft wastes on the bacteriological water quality of two sites in Puget Sound, although the influence had to be considered modest.

The sewage discharges from boats, however, must be regarded as a source of fresh fecal pollution, and this must be emphasized. Because of the freshness, a much greater potential for the presence and survival of disease-causing organisms exists in the discharges from boats than in the discharges from municipal sewage sources. In addition, the highly variable and unpredictable mobility of pleasure boats requires special consideration, particularly with regard to the potential for the contamination of shellfish beds.

Because shellfish are filter feeders, the condition of shellfish tissue definitely was the most noticeable indicator of sewage pollution in the water column. And, as has been demonstrated many times, there is a positive relationship between the consumption of inadequately cooked or raw, contaminated shellfish and disease. Noteworthy, also, is the health threat to those engaged in water contact sports in contaminated waters, which is always present but very difficult to substantiate.

RECOMMENDATIONS

Considering the state-of-the-art of marine sanitation technology at the present time, the total containment of sewage wastes on board the vessel, with subsequent onshore disposal, is the most practical solution to the problems related to protecting public health, keeping shellfish beds free of contamination, and negating the environmental insult resulting from the discharge of raw or inadequately treated sewage. Presently this can best be accomplished as follows:

- By installing Type III marine sanitation devices (holding tanks) on board all vessels that are equipped with toilet facilities;

- By eliminating the use of Type I and Type II marine sanitation devices. The former provides minimal, sporadic treatment at best, and the latter is generally unsuitable for use on small watercraft;
- By providing adequate numbers of clean, accessible, economical, and easily used pumpout stations;
- By reasonable and impartial enforcement of existing laws by the U.S. Coast Guard; and
- By providing clean and conveniently located, shore-based restroom facilities.

Finally, the writers strongly recommend that support be given to accelerate the research and development of new marine sanitation devices which would both properly treat the sewage wastes and be of practicable use on watercraft.

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A CASE FOR THE MANAGEMENT OF MARINE LITTER IN ATLANTIC CANADA

by

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INTRODUCTION

The beaches and shorelines of Atlantic Canada have a high value in attracting tourists to the Region. They also provide important recreational opportunities for local residents. Prince Edward Island, for example, received over 700,000 tourists in 1988, and Nova Scotia netted some $760 million tourist dollars in the same year. A large number of these visitors and their expenditures are directed toward beach and coastal vacations where they are attracted to the natural unpolluted beauty of Canada's Atlantic coastline. The potential is great for devaluating this resource through the careless, thoughtless and uncontrolled discharging of plastic debris and other persistent litter into marine waters. Shorelines in other parts of the world have become heavily littered, and Atlantic Canada is not unscratched in this issue. Persistent marine litter has been recognized as a problem here as well as elsewhere.

This paper describes the marine litter problem in Atlantic Canada, and some of the environmental concerns over litter; its evident impact on marine biota, as well as the safety and aesthetic appeal of coastal landscapes. It also describes some regional initiatives to control marine litter, and discusses further needs and management options.

Litter in Atlantic Coastal Waters

Plastics were developed during the late 1940s and their production increased astronomically throughout the 1960s and 70s. At the same time, their use expanded into every imaginable application to the point where plastics are literally found wherever human activity occurs. Plastics currently make up about 6.5% of landfilled waste (Franklin Assoc. Ltd. 1988). The durability and versatility of these synthetic polymers make them particularly attractive for use in nets, ropes, floats, and other fishing gear as well as the thousands of domestic uses in such items as containers, utensils, strapping, toys, sheeting and bags. The broad use of plastic items and the application of plastics in the fishing and marine industries lead to large quantities of plastic debris ending up in the oceans. These new plastic products make up large part of the marine trash along with other persistent debris such as metal and glass containers, metal cables, and other objects disgarded at sea or along the coast.

Despite the fact that marine litter was identified as a growing problem in Atlantic Canada in the 1970s, little was known about the magnitude of the problem since very few quantitative studies or surveys had been carried out. The problem of plastic litter was well described in Alaska (Merrell 1985), the Canadian North (Shearer and Bourque 1987), South Atlantic (Morris 1980) amongst others, but it was not really until the early 1980s, with the survey work of Z. Lucas on Sable Island, that litter in northwest Atlantic waters was studied quantitatively (Lucas, 1988).

Even on Sable Island, supposedly remote from land-based sources of debris, large quantities and varieties of plastic items and other persistent debris were identified. Some of the items were associated with the fishing industry; some obviously originated from foreign sources as determined by markings; most were probably dumped with domestic garbage from vessels operating in nearby waters. Table 1 shows the major types of Sable Island litter and their relative proportions. Lucas estimates that 60% of the identifiable items are Canadian in origin, 14% were U.S. and 25% from other countries. Plastic debris originating in Canada has been found in beach litter in other countries. (Dixon and Dixon 1983).

Table 1: Numbers of Items Found Over a Three Year Survey Period 1984 - 1986 on Sable Island

Type of Debris		# of Items	Percent Of Total
Fishing equipment	- net	1,344	12.0%
	- misc	56	.8%
Rope		1,829	16.1%
Other Plastic Items		7,139	63.8%
Glass		696	6.2%
Metal		119	1.1%
Total		11,183	100.0%

Source: Lucas 1988

A recent litter survey carried out in Halifax Harbour illustrates the problem that a large coastal city creates as a litter source. Butler et al. (1989) studied 19 sites, each containing 200 m of shoreline, at selected positions throughout the harbour area. Each site was sampled three times during October and November with all the accumulated material removed on the initial visit. Most of the total of 13,137 pieces of litter collected in this survey could be attributed to local sources; 32% were recreation related, 30% were from land based sources, 17% originated from the numerous sewer outfalls in the area, 11% were fishing related, and 1% could be related to general shipping and military activities (Figure 1). Over half the material collected was plastic (see Figure 2). Medical waste items were found at 9 of the 19 sites in the harbour and inner basin. This study concluded that, for the most part, local residents were responsible for marine litter problems in

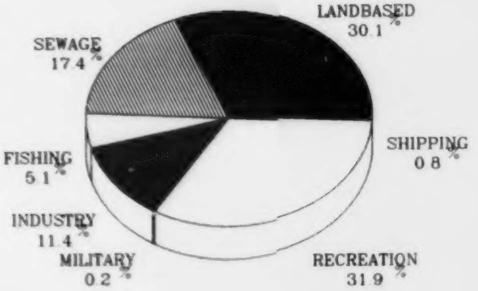

Figure 1 : Sources of litter in Halifax Harbour, percent of total (from : Butler et al, 1990).

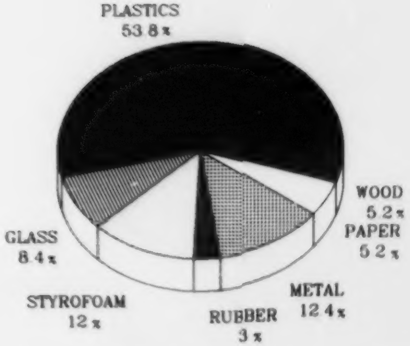

Figure 2 : Types of litter in Halifax Harbour; percent of total (from : Butler et al, 1990).

Halifax Harbour through boating and other recreational activities as well as waste discharged through the sewer system. The most common plastic items found, for instance, were plastic bags, tampon applicators, food wrappings, sheeting, and bottles.

Beach sweeps carried out in early 1989 by the Clean Nova Scotia Foundation also netted a high proportion of plastic. Over 60% of the 10,000 items collected from approximately 10 km of cleaned beach were plastic and styrofoam (See Table 2). The ten most commonly found items included styrofoam pieces, pieces of plastic, plastic rope, glass pieces, beverage cans and bottles, bits of paper, plastic tampon applicators, and plastic caps and lids (The Clean Nova Scotia Foundation 1989). The Clean Nova Scotia Foundation concluded that most beach litter originates from the normal domestic waste stream and probably finds its way into the sea by dumping from boats, "over-the-cliff" dumps, or from recreational beach users.

Table 2: Compositions of Debris Collected in 1989 Shoreline Cleanup (The Clean Nova Scotia Foundation 1989)

Item	Rank	%	# of items
Plastic	1	48	4,843
Styrofoam	2	14	1,406
Metal	3	12	1,169
Glass	4	11	1,082
Paper	5	10	1,018
Wood	6	2	261
Rubber	7	2	191
Cloth	8	1	117

Studies such as these are useful to establish a rough baseline to provide a general measure of the scope of the problem. They also provide a benchmark against which it is possible to measure improvements or trends. Two other such projects, which are currently being carried out under the Environmental Partners Fund Program of Environment Canada, already have provided data on marine litter accumulation in Albert County, New Brunswick and Newfoundland's Avalon Peninsula. In Albert County, out of over 11,500 items, 76% were plastic and styrofoam, 14% glass, 6% metal, with about 1% of each paper, rubber, wood and cloth. Although most of the debris was domestic garbage, about 11% of the items were identified as fishing gear. The largest proportion of items were beverage containers, followed by containers of various other types.

ECOLOGICAL CONCERNS

It is clear that the studies described here on marine litter in Atlantic Canada indicate significant local and widespread accumulations of persistent debris in marine waters and along the sea shore. Why should we be concerned about persistent marine litter, and why is it important to consider controlling or managing its occurrence?

Marine environmental quality is affected in several ways by marine litter: damage is caused to marine organisms through entanglement or ingestion, and plastics and other peristent marine litter impair the aesthetic beauty of beaches and coastlines, as well as the health and safety of users. This, and the growing burden of plastics in the environment, are the basis of our concern.

Entanglement

Over the past two decades, observations and studies have clearly pointed out the fact that a wide variety of marine animals become entangled each year in discarded nets, ropes, plastic strapping, six-pack yokes, monofilament, and other plastic debris (Carr 1987, Fowler 1987, Laist 1987, Shaughnessy 1980). The frequency of entanglement is hard to estimate accurately because many of the entangled animals sink or are eaten when they die, or just go unnoticed at sea or on remote coasts. Fowler and Ragen (1990) found that about 0.3% of male northern fur seals examined in 1989 were entangled. Similar numbers were reported for seals in the South Atlantic (Shaughnessy 1980).

Young seals are generally inquisitive and will investigate or play with floating plastic debris thus greatly increasing the risk of becoming entangled. Other marine mammals, as well as species of shark and marine turtles have been found similarly entangled (Carr 1987, Laist 1987, Cawthorn 1985). The result of being entangled in netting or rope is that the animal's movements are impaired, its mobility slowed, and its ability to catch food reduced leading to starvation. Collars of plastic strapping or rope can cause strangulation or can cut into the flesh of growing animals increasing their susceptibility to infection through open wounds.

Similarly, entanglement occurs when marine birds dive at floating litter in curiosity mistaking it for food. Seabirds have been found with their heads thrust through six-pack yokes, bits of netting, or entangled in monofilament (Schrey and Vauk 1987). Bird entanglement in plastic litter, relative to the number of ocean seabirds accidentally caught in set gillnets off the coast [22,000 estimated per year (Piatt and Nettleship 1987)] might be small, but there is insufficient data to estimate accurate numbers.

Unknown numbers of fish become entangled in ghost nets, discarded or lost fishing nets which continue to catch fish as they drift around unattended, sometimes for years. Again, losses due to this problem are difficult to determine.

Ingestion

Ingestion of plastic fragments, plastic bags, sheeting and other persistent debris by a variety of marine animals and seabirds has been well documented (Balazs 1985, Carr 1987, Cawthorn 1985, Day *et al*. 1985, Furness 1983). Sea turtles mistake plastic bags and sheeting for food. Larval fish and birds ingest plastic pellets and rubber and plastic fragments, mistaking them for plankton at the sea surface. Whales swallow debris along with fish or plankton that they pursue for food. Ingested debris can cause blockage of the digestive tract, perforation of the bowel, irritation of digestive system, or a false sense of fullness sufficient to lessen feeding urges. Any of these problems can lead to weakness, illness, decreased reproductive performance, or death (Laist 1987).

Safety, Aesthetics and Tourism

Litter in coastal waters and on beaches and shorelines can pose a threat to human safety as well as degrade the aesthetic attractiveness of the coastal landscape. Glass, hypodermic needles and other medical waste, metal pop tops, and rusty metal fragments pose a direct health threat to beach goers (Wagner 1989, Dixon and Dixon 1981) as do pyrotechnics or other military gear or hazardous materials washed up on shore. Rope, monofilament, net fragments, strapping, and wire can become entangled in boat propellers causing damage and endangering crews. Boats have also become disabled when cooling water intakes have been blocked by plastic bags or sheeting. These situations are not only costly in repairs and down-time for fishermen, but they can be life threatening in storm conditions or waters remote from help.

As stated earlier, tourism in the Atlantic Region is one of the more important industries. It depends, for a large part, on a high level of environmental quality, particularly in coastal areas to which tourists are attracted (Lamson and Donihee 1988). Beach litter incidents have been linked with the loss of tourist dollars on a number of occasions. For example, New York suffered an estimated loss of $1 billion in 1988 when unusual weather conditions caused garbage to be washed up on beaches there (Wagner 1989).

EFFORTS UNDERWAY TO DEAL WITH PERSISTENT MARINE LITTER

Overall, there are many activities underway in the Atlantic Provinces to deal with persistent litter in the marine environment. Some of these activities have been initiated by the various levels of government, but a significant portion of the effort has originated at the grass-roots level by concerned citizens, community groups and organizations with vested interest in the environmental quality of our oceans. These activities have taken many different forms from the passing of new, stricter government legislation to educational programs initiated by the public. In order to provide some insight into the types of activities underway, a brief description of some of these actions is provided.

National Level

On a national level, one of the key initiatives has been undertaken by the Canadian Council of Ministers of the Environment (CCME). In 1989, the council reached an agreement to develop a National Packaging Protocol by 1990 which would set targets and schedules for the minimization of packaging waste and would contribute towards a 50% reduction in waste generation by the year 2000. Any reduction in packaging should lead to a reduction in all types of litter, including some portion of the litter that washes up on our shorelines. The National Packaging Protocol was developed and accepted by CCME in June of 1990.

Federal Government

The **Canadian Coast Guard** has regulations made pursuant to the Canada Shipping Act which makes it illegal for any ship to dispose of garbage into Canadian waters. Although this is a very broad and all encompassing regulation, unfortunately it is next to impossible to enforce. If a ship decides to dispose of its garbage at sea where no one can observe the action, there is very little that can be done about it. In Atlantic Canada, there have only been a few prosecutions under this regulation since it was promulgated in 1969. Although the Coast Guard does not have the resources to monitor all shipping, they do use education and information in order to help with the voluntary compliance with this regulation. It is important that facilities for garbage collection and removal are available at Canadian Ports so that when ships are in port, they can conveniently dispose of their refuse and not hold it until they are out of sight of land to heave it over the side into the ocean. Two areas where the **Department of Fisheries and Oceans (DFO)** is involved in dealing with marine litter are gear improvements and provision of better harbour facilities for trash. They recently announced a year long study to look at the impacts of "ghost fishing" by lost gillnets in the Bay of Fundy. New regulations concerning gillnets will require that floats on gillnets be attached by biodegradable material so that if the net becomes lost, the floats will eventually break free from the net and the net will sink to the bottom instead of continuing to be suspended in the water column. The new regulations will also require gillnet fishermen to check their nets on a more frequent basis to reduce the risk of accidental loss.

DFO has become involved in the provision of refuse containers at wharfs managed by Small Craft Harbours so that fishermen can dispose of their garbage when they return to port. This program has been implemented successfully along the Northumberland Strait shore of Nova Scotia where a pilot project organized by the Maritime Fishermen's Union was being conducted. To date, Small Craft Harbours managers for other Nova Scotia ports have been less willing to provide this service at their facilities, but there is increasing pressure from the fishing community for these other areas to follow the Northumberland Strait example.

Environment Canada programs have provided support and financial assistance to groups interested in tackling the marine litter problem. The Environmental Partners Fund has supported five projects dealing with beach cleanups and litter assessment, anti-litter education, and public awareness about marine litter.

This year's Environment Week activities in Prince Edward Island included financial support to several beach cleanup projects. Also support was provided to the Maritime Fishermen's Union Clean Oceans Program.

Provincial Governments

Nova Scotia

In 1988, the Clean Nova Scotia Foundation was formed by the Nova Scotia government. The Foundation's mandate was to raise public awareness about litter in an effort to reduce the overall litter problem at recreational areas, roadsides, and along the coast. With the increasing importance of tourism to the province's economy, it was felt that the litter situation in Nova Scotia might become a limiting factor to the growth of that industry. The Foundation has used television, radio, and newspaper advertisements to get the message out to the people that proper disposal of litter is important to all residents of the province. One of the most successful campaigns conducted by the CNSF to date has been their "beach sweeps". In the spring and fall, hundreds of volunteers are organized to pick up and enumerate litter from most of the recreational beaches in the province. In September, 1989, 683 volunteers cleaned 83 kilometres of beach in Nova Scotia, and removed 38,765 items (8,310 lbs.) of debris (O'Hara and Younger 1990). This program has generated a lot of media attention and the public response has been very good.

Nova Scotia passed a new, tougher anti-litter law in June of 1990. The new law imposes fines of up to $2,000 for littering, but more important, it spells out a strict enforcement policy by the province's peace officers. It is too early to measure the effect of this revised statute, but it is felt that it should have a positive impact on reducing littering in the province.

The governments of Nova Scotia and Canada, along with the municipalities around Halifax Harbour, signed an agreement in 1989 to cost share on the implementation of sewage treatment for Halifax, Dartmouth and the surrounding communities. At the present time, about 80% of the sewage from these communities enters Halifax Harbour untreated (Halifax Harbour Task Force 1990). About 20% of the persistent shoreline litter found around the Harbour can be attributed to that untreated sewage (Butler et al. 1990). Once the sewage treatment plant is completed, an obvious reduction in shoreline litter should result.

Although only in their infancy, recycling programs are becoming more widespread and organized around the province. As these programs become more successful, the amount of household waste destined for landfills and incinerators will be reduced, as will, hopefully, litter on our shorelines.

New Brunswick

In 1989, the New Brunswick government formed a Legislative Committee to study the problem of litter in that province and to recommend an action plan to deal with the situation. Although the final report from the committee is not expected until this fall, it is anticipated that an Advanced Litter Control Program will be proposed. Such programs have been quite successful in about fifteen states in the USA. This type of program integrates education, public awareness, recycling, deposit/refund systems for beverage containers, and an Adopt-A-Highway program. Under this Adopt-A-Highway program, a local group of volunteers assumes responsibility for a stretch of local highway; the group is required to clean the roadsides several times per year and signs are posted indicating the communities involvement in keeping the highway free of litter.

Prince Edward Island

The provincial government of Prince Edward Island eliminated the use of no deposit/no return beverage containers in 1990(PEI 1989).

Since that time, all soft drink and beer containers had to be returnable and refillable. The program has been quite successful in reducing littering of these kinds of containers.

Marine Atlantic, who operate the ferries between New Brunswick and P.E.I., have initiated an anti-litter campaign this year. The campaign consists of posters on the ferries and in the terminal building and recorded messages on the boats explaining the problem of marine litter and asking people travelling on the ferries not to throw garbage into the Northumberland Strait from the ferries.

Newfoundland

The issue of litter in the marine environment has not received a great deal of attention to date in the province of Newfoundland. The only government sponsored program we could identify was the recovery of abandoned automobile bodies from shoreline areas. However, at the grass-roots level, the problem is beginning to attract some attention and this may be an effective means of increasing the provincial governments interest and involvement in this problem.

Non-Government Organizations

In Atlantic Canada, activities by non-government agencies to study and deal with the problem of marine litter have occurred on several quite diverse fronts. Beach cleanups and litter surveys have been conducted by local interest groups in all four provinces. Some of this work has been conducted independently by these organizations but some of it has been conducted with the support and financial assistance of various levels of government.

In Prince Edward Island, a group known as Parks and People Association organized cleanups on the beaches in the National Park on the north shore of the island as an Environment Week project in June, 1990. The P.E.I. Shellfish Association, with assistance from

Environment Canada, organized shoreline cleanups of sixteen kilometres of shoreline in the Summerside area as their Environment Week project. In the Charlottetown area, the shoreline was cleaned by 250 students in a project organized by the P.E.I. Natural History Society, the Island Nature Trust and the P.E.I. Shellfish Association, and supported by local businesses.

In New Brunswick and Newfoundland, beach surveys and cleanups have been organized by several local interest groups with the support of the Environmental Partners Fund administered by Environment Canada. These projects are more comprehensive than the one or two day blitzes commonly seen. These projects aim at documenting the amount, type, source and accumulation of shoreline litter in their study areas. Along the Avalon Peninsula in Newfoundland, a 5-month study of 15 beaches was organized by the Newfoundland and Labrador Environmental Association in early 1990. A 6-month study has just been completed in the Carmanville area led by the Gander Bay-Hamilton Sound Development Association. Along with cleanup activities, both of these projects involved public awareness components.

A one-year project known as Coastal Watch began in May, 1990 along the Bay of Fundy and Northumberland Strait shores of New Brunswick. Among the organizers of this project are the Albert County Heritage Trust, Fundy Guild, the New Brunswick Federation of Naturalists and the World Wildlife Fund. Marine litter will be surveyed along both coasts and a public awareness program will be developed and implemented. A similar 6-month project is underway in the Chance Harbour/Dipper Harbour area. A local organization known as Shore Watch is the leader of this project. So far 41 beaches have been cleaned and 26 are being monitored for litter accumulation. About 26,000 items of shoreline litter have been collected.

One of the most innovative and successful projects to date has been the **Clean Oceans Project** of the **Maritime Fisherman's Union** (MFU). This organization represents 2,500 commercial fishermen in the

Maritime Provinces. In 1989, the MFU formed a Clean Oceans Committee. This committee organized a pilot project in the fishing communities along the Northumberland Strait shore of Nova Scotia. The project was aimed at convincing fishermen to install garbage containers on their vessels and bring back domestic garbage, broken fishing gear and pieces of rope and net rather than throwing it over the side. The project also involved getting garbage containers placed at the wharfs in the communities so that the fishermen would have a proper place to dispose of their garbage on shore. The pilot study was very successful with 90% of the fishermen in the study area participating in the project. At present, the MFU is working to expand the program to all of their members in the Maritime provinces. The MFU has received financial assistance from the three provincial governments and Environment Canada. They are also cooperating with the Eastern Fishermen's Federation, the other major fishermen's organization in Atlantic Canada.

Besides working to convince commercial fishermen to participate in the Clean Oceans Campaign, the MFU is also lobbying recreational boaters to join with them in their efforts to reduce the disposal of persistent litter into the coastal waters around Atlantic Canada.

MANAGEMENT NEEDS AND OPTIONS

This paper has, so far, outlined the state of knowledge concerning marine litter in Atlantic Canada and discussed some of the problems associated with such debris. It also describes some of the initiatives underway to assess or control the problem in Canadian waters; but the question still remains. What other management needs and options are there?

These questions are dealt with in detail in a background paper prepared for a workshop held in Halifax in May, 1989 (Buxton 1989). Some of the major needs and options for management of marine litter will be highlighted here.

International Initiatives

Many countries around the world have recognized the non partisan nature of marine litter in that all countries bordering on or using the common oceans contribute to a litter problem that effect ecosystems and coastlines other than their own. They have come to address this problem at an international level through MARPOL Annex V (a section of the International Convention for the Prevention of Pollution from Ships). MARPOL prohibits the discharge of plastics at sea, but allows limited garbage disposal from ship operations.

Canada is one of the few western nations not yet signatory to MARPOL. Reasons given relate to the Canada Shipping Act which prohibits all garbage disposal from any ship in Canadian waters, and thus is more stringent than MARPOL. Nevertheless, despite the complexity of this decision, it is generally considered that Canada should ratify MARPOL Annex V as a show of leadership and in the interests of the common oceans. It might also stimulate enforcement action, something which has been sorely lacking within the Canada Shipping Act.

Federal Initiatives

The Canada Shipping Act (CSA) has recently been amended, effective April, 1989, to strengthen its jurisdiction and penalties. With these modifications Canada is in a better position to ratify MARPOL should that decision be taken. Still the greatest problem with the CSA is ineffective enforcement. The difficulty of policing all shipping is obvious, however, stronger and more effective enforcement of the Garbage Pollution Prevention Regulations of the CSA is an initiative that must be taken more seriously.

The Small Craft Harbours program of Fisheries and Oceans Canada is responsible for the development and operation of most of the small harbours, dock and boating facilities in Atlantic coastal waters. These facilities, which handle fishing boats, and a large variety of commercial and recreational boating, are generally supervised by harbour managers retained by DFO. With growing pressure on fishermen and boaters to bring back their trash, there is an essential need for on-the-wharf garbage disposal facilities. DFO has been responsive to this need, as have some communities, but the response has not been uniform throughout the region. The roles of DFO, the community, and the harbour users themselves need to be examined so that effective, consistent and uniform garbage collection at dock side can be established. This, in fact, would be an essential prerequisite of Canada's ratification of MARPOL.

Federal/Provincial Perogatives

Some areas of marine litter management fall within the jurisdiction of both federal and provincial governments. The CCME National Packaging Protocol, described earlier, is an example of a shared federal/provincial initiative to reduce packaging and thus manage the garbage and potential litter burden. Governments, in concert with industry, must move ahead on this initiative in the interest of reducing unnecessary garbage, but more importantly for this issue, to reduce the persistent and/or hazardous kinds of litter that threaten marine life or foul shorelines. Another area for both federal and provincial initiatives, and one which has a strong community interest, is environmental education. All things considered, this may be the most important area from which effective, long-term changes in peoples attitude toward litter arise. Governments and communities have recognized this as shown by initiatives such as the Clean Nova Scotia Foundation, the Environmental Partners Fund, and the Clean Oceans Project of the MFU. These good beginnings can build toward a broader and deeper educational effort aimed at marine industries, users, and the general public. The United States have advanced well in this area and can provide useful models.

Provincial and Community Initiatives

The provinces have broad scope for the enactment of anti-litter legislation or the strengthening of such laws. For example, Prince Edward Island is one of the few provinces in Canada that outlaws the use of non-returnable beverage containers. Beverage containers made up 14% and 13% of the beach litter in N.B. and N.S. respectively (O'Hara and Younger 1990). Unfortunately, no such data was available for P.E.I., however, U.S. states with beverage container deposit laws generally had lower beach counts of containers than states without such legislation.

Similar anti-litter legislation might be applied to such things as balloon releases (outlawed in some U.S. states), or the use of non-biodegradable six-pack yokes. Better enforcement of anti-litter laws and higher fines have been effective in reducing litter in some provinces.

Sewage discharge has been identified as a chronic source of persistent litter. Control of this source is, for the most part, the responsibility of the community or municipality. As well, many beaches, in fact, are recreation areas managed by the local community, and it is essential that facilities be provided for garbage disposal, and that they be maintained and emptied regularly.

Industry

Despite the good will of the public and their sensitivity to the marine litter issue, it is sometimes impossible to avoid using or disposing of items that have the potential of becoming persistent litter because choices are limtied. With the growth of fast food facilities and the overwhelming use of so many disposable or throw-away plastic utensils, plates, straws, cups and containers, it is little wonder that these items make up the highest proportion of beached plastic litter. There should be a move toward reusable or recyclable materials in the fast-food industry, with the development of an efficient and safe technology for washing and sterilizing reusable utensils, or for promoting recyclable materials.

Biodegradable or photodegradable plastics are now considered unsuitable because they breakdown into smaller ingestible fragments. But there are other technologies that should be applied in the plastics industry that could make this incredibly useful material more environmentally friendly. There may even be situations where a more suitable material could be substituted with less environmental cost. Industry and governments for that matter, should be encouraged to consider environmental costs associated with the use of manufactured materials and direct research into new technologies accordingly.

In conclusion, this paper has described the marine litter problem in Atlantic Canada and the impact that it has on marine biota and the coastal environment. Some work is underway to control marine litter, but more effort is needed to manage this problem particularly in the areas of enforcement, education, technology and improved facilities. More initiative is needed at all government levels and internationally as well as at the community and personal level, to eventually take this manageable problem and gain control over it.

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BEACHED BIRDS AS INDICATORS OF MARINE OIL POLLUTION IN NEWFOUNDLAND

by

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Introduction

The southeast coast of Newfoundland and adjacent Grand Banks is one of the most important areas for seabirds in the world. During the summer, several species breed in six very large colonies on the Avalon Peninsula and Funk Island and in many smaller colonies around the entire coast. In addition, seabirds from the southern hemisphere migrate to Newfoundland waters to spend their "winter" during the northern summer (Brown et al. 1975, Brown 1986). In the winter months, migrant seabirds from Europe and the arctic join resident populations to feed in offshore and inshore waters around the island.

Coincidentally, the island of Newfoundland lies along a great circle route connecting the most industrialized regions of Europe and North America; trans-Atlantic shipping converges off Cape Race and also passes through the Strait of Belle Isle during ice-free months (May-Dec). Furthermore, most of the goods that are imported or exported to or from the island moves by ship. To this already high level of shipping activity can be added that generated by the intensive inshore and offshore fishery, served by thousands of boats, both small and large. All these activities carry with them a high potential for oil release into surrounding waters. Most notable are large spills of fuel or cargo oil usually caused by accidents. However, another, less publicized class of oil release involves the deliberate dumping of relatively small amounts of oil through bilge pumping, tank flushing or ballasting. These latter types of oil release are germane to the theme of this conference and sit squarely as a waste management issue, in this case that of oil generated through ship operations.

Given these observations, it is not surprising that oiled seabirds, both dead and alive, have washed up on Newfoundland shores for many years (Tuck 1959, 1961, Piatt et al. 1985). Of all organisms that suffer from oil pollution in marine environments, seabirds are perhaps the most affected. All true seabirds gain most of their food from the sea and often loaf or roost on the sea surface. Although all northern seabirds have the ability to fly, many are flightless due to wing moult at certain times of the year and are unable to escape an oil slick. This makes them very vulnerable to contacting oil floating on water. Once a seabird is oiled, debilitation usually takes place, caused by loss of buoyancy, hypothermia and the added toxic effects of oil ingestion. The bird either dies at sea or swims to shore. Corpses of birds that die at sea can suffer one of several fates (e.g., sinking, disintegration, being scavenged) but a small proportion drift to shore and are deposited on beaches.

It has been recognized for many years that shoreline surveys can be used to monitor the effects of oil pollution on marine birds, and "beached bird surveys" as they are called, have been, or continue to be conducted in several countries for this reason (e.g., Kuyken 1978, Stowe 1982, Simons 1985, Camphuysen 1989, Vauk et al. 1990). Surveys of Newfoundland beaches have been conducted sporadically since the 1950s and the results up to 1984 were summarized by Piatt et al. (1985). Since 1984, the Canadian Wildlife Service (CWS) has performed monthly surveys of 25 beaches in the southern portion of the Avalon Peninsula, insular Newfoundland, and it is the preliminary results from these surveys that we present here.

Methods

Standard methods (see Stowe 1982) were used to survey 25 beaches in the south Avalon study area once every month. The study area comprised the south Avalon Peninsula coastline from Point Verde, Placentia Bay, south on the Cape Shore to St. Brides, then around to Branch on St. Mary's Bay, and from Point La Haye on the east side of St. Mary's Bay around to Ferryland on the Southern Shore. The study area was chosen because of its proximity to the local CWS office and to major shipping lanes and because historical accounts indicated a relatively high incidence of oil release events and oiled bird reports in this area. Survey beaches were chosen for ease of access and were spread as fairly evenly within the study area. Beaches ranged from 50 to 1900 m in length and averaged about 0.5 km in length. The total linear length of the survey was about 12 km. All dead birds found on beaches were identified to species. In addition to beached birds, the presence or absence of fresh oil on the survey beaches was noted on each visit. Data from 1984 through 1988 are presented here during which a total of 1353 beach surveys were conducted.

Results

1. Beached birds and oiling rates by taxonomic group and species

A total of 3,165 birds were found on surveyed beaches during the study period. Of these 1,649 could be coded reliably as oiled or not (termed "coded" group). Twenty-three percent of coded birds were oiled. Table 1 shows a breakdown of all birds found by taxonomic group.

Table 1. Number of birds found, coded and oiled by taxonomic group. Data are from 1984-1988 inclusive

Group	Found (n)	Coded (n_1)	Oiled (n)	Proportion oiled (oiled/n_1)
Auks	1934	1047	333	0.32
Seaducks	64	31	10	0.32
Gannets	37	27	6	0.22
Tubenoses	198	122	12	0.10
Larids (mainly Gulls)	917	415	23	0.06
Other	15	7	1	0.14

The auks (Alcidae: murre, puffin, dovekie, guillemot, razorbill) were most commonly found on beaches, followed by larids (mainly gulls). However, their rates of oiling differed markedly with 32% of auks being oiled in contrast to only 6% for larids. Seaducks (eider, scoter, oldsquaw, harlequin) were oiled at a similar rate to auks.

Table 2 shows a species breakdown of the auk data shown in Table 1. We found considerable variation in rates of oiling within the auks. Thick-billed Murres and murres that could not be identified to species were the most commonly oiled. A large number of Dovekies (Alle alle) were found on beaches; many of these appeared in January, 1984, during a large "wreck" of this species.

Table 2. Number of auks found, coded and oiled by species. Data are from 1984-1988 inclusive

Species	Found (n)	Coded (n_1)	Oiled (n)	Proportion oiled (oiled/n_1)
Unidentified Murre	353	91	56	0.62
Thick-billed Murre	212	147	84	0.57
Black Guillemot	49	22	6	0.27
Dovekie	959	513	129	0.25
Razorbill	5	4	1	0.25
Common Murre	309	237	50	0.21
Atlantic Puffin	43	33	7	0.21
unknown species	4	0	0	-

2. Monthly and yearly trends

The average number of birds found per beach visit in each year of study is shown in Figure 1. Averages were weighted and calculated by dividing the total number of birds found by the number of beaches visited. If the 1984 wreck of Dovekies is excluded from the analysis, about two birds were found on every beach visit, with relatively little inter-year variation. Fewer birds were found on beaches in 1988 than in previous years and with the exception of 1987, there appears to be a gradual decreasing trend in the number of birds found.

The proportion of coded beached birds that were oiled for each year of the study is shown in Figure 2. The proportion varied from about 15% in 1987 to 31% in 1988 but there appeared to be no trend toward either increasing or decreasing rates of oiling over the study period. The difference in the proportions between years was significant ($\chi^2 =$ 22.4, df = 4, $p < 0.0005$) with the highest rate of oiling occurring in 1988.

The proportion of coded birds found oiled for each two-month period through the year is shown in Figure 3. Oiled birds were found on survey beaches almost every month of the year for all years studied. For all years, rates of oiling were much higher during the winter (Nov-Apr) than during summer (May-Oct).

Although oiled corpses were regularly picked up on survey beaches, the frequency with which we found oil on beaches was very low. Of 1339 beach visits on which the presence/absence of oil on the substrate was recorded, oil was seen on only 63 (5%) occasions.

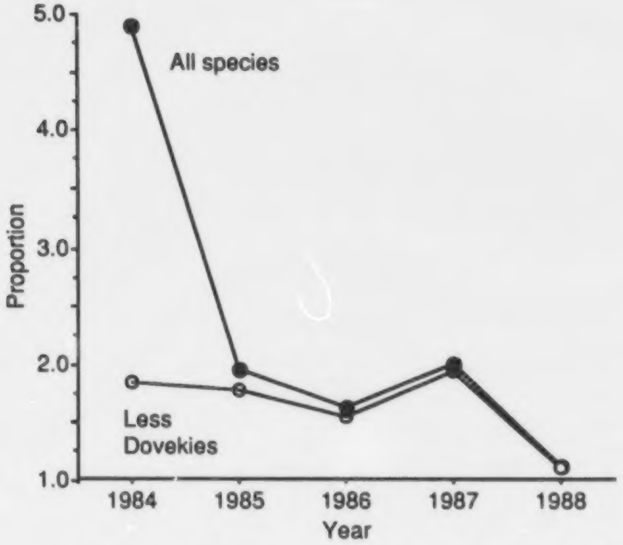

Figure 1. The average number of birds found per beach visit for each year of study.

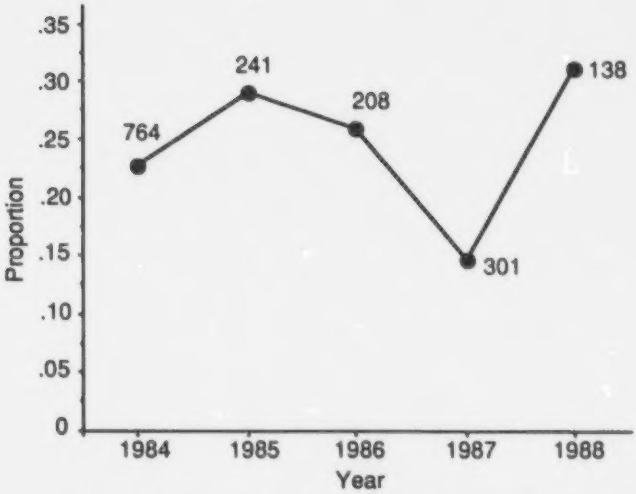

Figure 2. The proportion of coded birds found oiled in each year. Sample sizes are shown

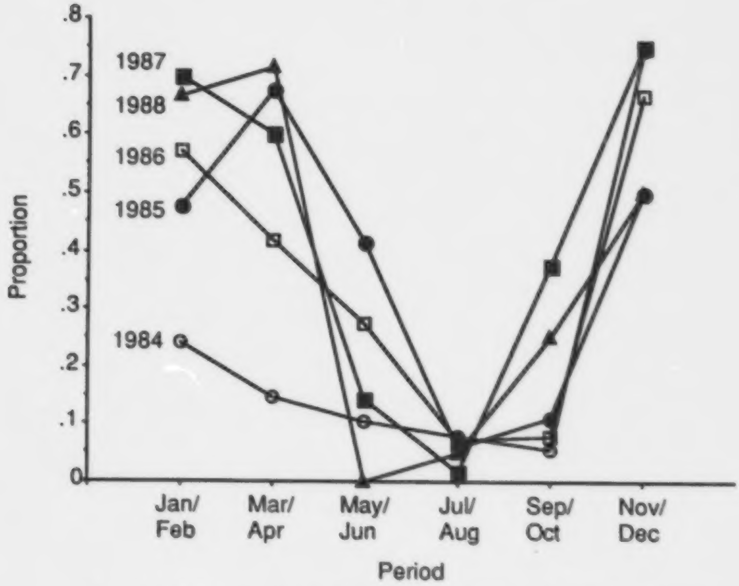

Figure 3. The proportion of coded birds found oiled for each 2-month period of the study

Discussion

The data presented here provide a valuable baseline against which future surveys can be compared. On average, about two birds were found on each beach visit and of those that could be coded, about 23% were oiled. These figures are lower than those given by Piatt et al. (1985) for surveys conducted from 1974-1984 who reported an average of 4.0 birds per beach, of which 43% were oiled. However, these earlier surveys were conducted between November-April when rates of oiling are highest; thus, the datasets are not directly comparable. In the future, offshore oil development could increase the amount of oil released into Newfoundland waters and beached bird surveys will provide an index of the impact of such development on seabirds in the area. Against this trend, the effectiveness of efforts to reduce oil releases, and thus, rates of seabird oiling also will be measurable.

Oiled seabirds were found on survey beaches in all months of the year, indicating that oil was released constantly into Newfoundland waters during the study period. No large spills occurred during that time. This type of chronic oil pollution was recognized as a problem in southern Newfoundland by Tuck (1961) more than thirty years ago and the present situation does not appear to qualitatively differ from then. Tuck (1961) estimated that 500,000 seabirds were killed annually in Newfoundland by chronic oil pollution. Later, Piatt et al. (1985) estimated an annual mortality from oil of 20,000-100,000 birds. Clearly, if these estimates are accurate even to the nearest order of magnitude, they indicate that seabird mortality due to chronic oiling can be as significant as that caused by well-publicized, large oil spills (e.g., Bourne et al. 1967, Hope-Jones et al. 1970, Brown et al. 1973, Hope-Jones et al. 1978, Piatt et al. 1990).

The question of how many seabirds die in Newfoundland waters due to chronic oiling is very difficult to answer and we will not attempt this here, based on the more recent data presented. However, a few points are worth discussion. Extrapolation from beach surveys to total number of birds affected depends on the use of a factor to account for birds that die from oiling but are not recovered. Corpse-drift experiments (e.g., Bibby and Lloyd 1977, Bibby 1981) attempt, among other goals, to estimate the value of this factor. However, it is likely that values are sensitive both to local average conditions (e.g., currents, prevailing winds, bird distributions relative to shore) and the particular conditions obtaining at the time of the experiment, and are of little value unless generated locally and averaged over a considerable period of time. Such data are not available for Newfoundland at present. It is safe to say however, that the number of oiled birds found during surveys likely represents only a very small fraction of those actually oiled. Once a seabird succumbs to oiling at sea, the corpse could sink, be scavenged, disintegrate or drift away from shore. Once deposited on shore, the corpse could be scavenged, buried by sand, pebbles, seaweed or snow/ice or removed by wave action before a survey. Finally, many corpses are probably deposited on beaches or other types of shoreline that are not surveyed. The reliability of estimates of total mortality due to oiling depends on how representative are the survey beaches. Survey beaches in this study likely over-sample oiled corpses because prevailing winds and currents tend to push corpses toward the shore at this location. Thus, we feel that more work needs to be done before estimates of mortality due to oiling in Newfoundland waters can be generated from beached bird survey data.

Considerable variation was found in the number of birds found and rates of oiling both between species and over time (within and between years). The rate of oiling of beached birds was higher in winter than in summer for all years studied. This trend has been found elsewhere (e.g., Bourne and Bibby 1975, Stowe 1982). Several factors could be responsible. Ships may produce more waste oil during the rougher seas experienced during winter months and crews may be more apt to dump oil when the longer winter nights reduce the chance of detection. The winter distribution of seabirds in Newfoundland waters may put them at a higher risk of oiling. Higher winds and colder sea surface and air temperatures in winter could interact to increase the "oiling potential" of a slick. Winds move oil slicks around and in general, the more a slick moves the greater the chances that it will contact birds. Cold temperatures experienced in winter decrease the rate at which oil "weathers" to tar-balls and under these conditions the oil remains liquid and able to foul birds' feathers for longer periods. Finally, winter weather may enhance the rate at which birds are deposited on beaches and reduce the rate at which beached corpses decompose.

The numbers of each seabird species found on surveys broadly reflects their relative abundance in coastal Newfoundland waters. Auks and gulls were the commonest seabirds found on surveys and this correlates with their abundance both as breeders and winter visitors (Brown et al. 1975, Brown 1986). The tubenoses (Procellariidae) represent an interesting exception to this trend: the Leach's Storm-Petrel (Oceanodroma leucorhoa) breeding population is probably the largest of any Newfoundland seabird and over 5 million shearwaters migrate to Newfoundland waters for the summer (Brown et al. 1975), yet this group of seabirds was found much less commonly than auks or gulls. Storm-Petrels are the smallest of Newfoundland's seabirds and thus corpses probably do not "survive" as long on beaches as larger species. Furthermore, species in this group tend to be distributed farther off shore (in particular around the Grand Banks in winter) and their corpses are less likely to drift ashore.

As expected, the auks and seaducks were the most frequently oiled. These species are highly aquatic, spending much of their time swimming on the surface of the water or diving for food, and thus are likely to come into contact with oil slicks more frequently than aerial species such as the larids and tubenoses. This observation underlines the particular vulnerability to oil pollution of auk and seaduck species. Thick-billed Murres were oiled at higher rates than other auks, probably because they are chiefly a winter visitor to Newfoundland, at which time rates of oiling are markedly higher than in summer.

Clearly, beached bird surveys are a simple and relatively cheap method by which oil pollution can be monitored in water bodies. The presence of oiled bird corpses on our survey beaches was often the only indication that an oiling event had taken place, and in the rare event that oil was found on beaches, it was invariably preceded or accompanied by oiled birds, either alive or dead. The preliminary analyses presented here show how beached bird surveys also give us insight into questions such as how different species of seabirds are affected, at what levels they are affected, and when. Oiled seabirds also provide perhaps the quickest, safest and most efficient method of obtaining samples of oil for use in investigations by enforcement agencies. We need to be able to monitor the effects of ever-increasing commerce, both in the form of shipping and off-shore oil development, on the marine environment of Newfoundland, and to measure the effect of programs designed to reduce oil pollution; beached bird surveys provide us with a cost-effective means of doing so.

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AVOIDING POLLUTION PROBLEMS AND AMELIORATING SOIL THROUGH COMPOSTING SEAFOOD WASTES

by

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SUMMARY

Some seafood wastes are being composted at commercial scale in Canada through the novel, facile and inexpensive passively aerated windrow system. The compost produced can be exceptionally rich in nutrients and has a high capacity for ameliorating degraded soils by the restitution of their humus content. The approach thus avoids the pollution caused by improper disposal of the wastes as well as restores soil quality.

Biological industries tend to produce large proportions of residues, byproducts or cullings. In an affluent society, most of these are regarded as wastes. Fisheries is no exception. Proportion of the so-called waste from fisheries may be higher than 90% when only roe (eggs) is taken from herring or other fishes, or when a total landing is found to have spoiled. When members of the cod family of fishes are filleted, 40 to 60 % of the catch is scrapped. Slicing the fishes for steaks, and canning, generate 30% cullings and other waste. The shell and other discarded parts of crustaceans like lobster, shrimp and crab comprise 1/3 to 4/5 of their landed weights.

Little waste is generated by the marketing of whole fish. However, all landed catches contain some fishes of unsuitable species, size or state - the so-called bycatch which includes the fishes crushed in dragnets.

Precise estimates of the amount of waste generated by commercial fisheries are not readily available. However, statistics on total landings, output of fish meal plants, and marketed products suggest that cod family fishes alone are the source of 140 to 200 thousand metric tonnes of waste per year solely in Canada. The corresponding figure for the U.S. is about 2 million metric tonnes.

A new source of fisheries wastes is aquaculture where 7 to 30% of the fish reared at high density turn up as 'morts'. These are whole carcasses.

The Nature and Properties of Seafood Wastes:

The finfish wastes include whole fish, offal that is mostly viscera, and the fish scrap (racks) that is the residue of filleting. The residue includes heads, backbones, tails, skin and fins. The fish wastes are therefore high in proteins and bone phosphate. Some lipids are also present. Dogfish gurry, however, being from a shark, is boneless but contains cartilageous heads, the tough sharkskin, tails and viscera, all in a slurry. Shellfish wastes are comprised mostly of chitin (poly-N-acetyl-glucosamine) encrusted with Ca and P compounds. Some meat, especially in appendages, is also present. It is therefore not surprising that seafood wastes contain high levels of bioessential elements, up to 14% N, 7% P2O5 and 15% Ca (Brinton and Seekins, 1988).

The N and P alone make the wastes highly valuable as a manure. However, manuring with fisheries wastes is problematic due to their chemical nature. Most of their N and S are present in polymers, which can be readily hydrolyzed by autolytic or microbial exoenzymes.

The autolytic enzymes are released by cellular death, and are thus present in soil and putrefying materials. The exoenzymes function independently outside of their parent cells, and even far removed from them in both time and space. Exoenzymes in soils continue to operate at temperatures as low as -20°C, while most microbial growth ceases at 4°C (Mathur 1982). Such enzymes include proteases, chitinase and lipases that exothermically hydrolyze proteins, chitin and lipids (fats and oils) respectively, needing only water to accomplish the degradation, not oxygen. Consequently, ammonia, amines, sulphamines, and fatty acids can be released from the fish wastes even before conditions are suitable for their biological oxidation through the growth of microorganisms. The amines and sulphamines include cadaverine, mercaptan, skatole, ptomaine, and putrescine. The very names suggest extremely foul odours.

The fats and oils in fishes are polyunsaturated. The significance of this property of the seafood waste is that the lipids and their products auto-oxidize rapidly in air to generate foul rancid odours. Seafood wastes therefore generate malodours inexorably, irrespective of whether air and microbial activity are present or not. The odours and soluble products attract nuisance birds and insects. Fly maggots, therefore, are a common problem.

Seafood wastes, being animal biomass, are highly biodegradable and nutrient rich. Loose piles of seafood wastes therefore self-heat due to rapid thermophilic microbial activity. The decomposition indeed is so fast, and ammonia released far in excess of the requirement of the decomposer population, that much of the ammonia produced by abiotic and exothermic enzymatic hydrolysis and deamination is lost as vapour from ordinary aerobic composts, and from the land manured with the wastes. The heat generated further accelerates the enzymatic processes that generate the amines and ammonia. The loss of ammonia is further spurred by the presence of calcium in the wastes. The calcium raises the pH of the medium beyond the capacity of the water to keep ammonia in dissolved or ionic form. The solubilization of Ca from the bones and exoskeletons is aided by the heat and CO2 generated by microbial activity (see Mathur et al, 1987).

Some Current and Past Disposal Techniques:

The above indicates that land manuring with seafood wastes does not conserve the ammonia unless fresh waste is immediately ploughed in before planting, as was the case with the burial of a fish under each hill of corn practiced by some American Indians. In practical terms, however, land internment of the fisheries wastes can only be effected when the soil is not frozen, not too wet, not too dry, not under a pasture, and not covered by a standing crop. In other words, the opportunity for such use in Canada is a very narrow window indeed. Landspreading on pasture is a wasteful option that also raises 'a stink' with the neighbourhood, environmentalists, and regulatory agencies.

The disposal of fisheries wastes out at sea is deterred by the necessity to use a vessel different from the boats and ships that bring in the catch. On-board processing in factory ships is not common in Canada for various reasons although it provides a good opportunity to dispose any wastes in a manner that is benign compared to the dumping of wastes in small areas on or near shores. The disposal near shores causes local eutrophication and habitat perturbation.

The use of raw fish waste as feed for fur-bearing animals is per se without adverse environmental impact but in some ways transfers the problem, albeit at a smaller scale, to the disposal of the furless animal carcasses.

The cooking, grinding, and dehydration of the wastes into finfish and shellfish powders, or meals, for use as animal feed, naturally generates odours. As few communities remain entirely dependent on fishery, the acceptability of fishmeal plants to their neighbours has decreased drastically. The use of fishmeal as protein supplement has to be limited to a small percentage of the total animal ration, to avoid having the beef, pork, or fowl smell like fish. The fishmeal from the wastes has also to compete with the more suitable by-product plant proteins from the oilseed and cotton industries, and from the tropical, easily processed small fishes. The profitable markets for fishmeal, fish hydrolysates, silages and fish oils are therefore limited and capricious.

One needs to recognize that disposal of seafood wastes by their placement in uncovered dumps is unacceptable from both aesthetic and environmental viewpoints. The run-off from the dumps is nutrient-rich and the smell highly objectionable. Proper disposal by burial in modern high-tech landfills is expensive and in some cases only delay and stagger pollution, not prevent it. Recent concerns about methane and N2O from landfills and from any groundwater contaminated by them are also noteworthy. Landfill sites can be aerobic at surface where nitrates are generated and anaerobic below surface where the nitrates can be denitrified to generate NOx and N2O.

Composting of Seafood Wastes - the Old Methods:

Before the advent of chemical fertilizers, farmers and gardeners sought and used biological wastes to manure their lands. The more enlightened ones composted the waste before application to land, as composting reduced the bulk, sanitized the wastes, conserved the nutrients to produce a humus-rich product that both conditioned soils and nourished plants. Also, unlike most chemical fertilizers, the plant nutrients in compost are not all water soluble and consequently not subject to loss through run off and leaching. Further, unlike raw wastes, composts do not have to be ploughed in immediately, and create no problems of vermins and nuisance insects, nor pose health hazards to man, crops or farm animals. Composts can therefore be spread with impunity on any ground that can be traversed.

Composting starts with match making. Most materials require to be mixed with others to obtain proper conditions of physical state, pH, C/N ratio, and moisture content. As the seafood wastes tend to be alkaline due to the ammonia released, and the Ca present, they have to be matched with materials that are acidic, or acidogenic, or both. Being N-rich, the seafood wastes need to be mixed with N-poor organic material. As seafood wastes, depending on the source, can be wet or relatively dry, and be of low or high density, requirements for obtaining optimal moisture content and suitable openness in the mix vary. Many references of individual experiences rather than scientific studies are therefore found regarding the composting of seafood wastes with banana or citrus wastes, river muds, seaweeds, farmyard manure, bark and muck (e.g. Rodale, 1960; Krishna Murthy, 1978). Most of these materials are only mildly acidic at best, or have low buffering capacities, or fail to prevent anaerobic decomposition due to their physical state before or during degradation.

Decomposition by microbes in the absence of oxygen, i.e. under anaerobiosis, produces malodorous substances like reduced N and S compounds but cannot oxidize them to the odourless $NO3^-$, CO2, $SO4^{--}$, and H_2O. Thus, both the NH_3 and malodours remain in the waterlogged soils treated with seafood wastes, and in the cold anaerobic composts of these wastes. Also, the lipids in the cold composts attract fat-eating ants (Rodale, 1960).

Composting of seafood wastes with bark or sawdust has also been attempted (e.g. Brinton and Seekins, 1988). The problems with composting of wood wastes is mainly due to their chemical composition. The cellulose in wood is readily biodegradable while the lignin not only degrades slowly but it also releases soluble bioinhibitory phenolics into the compost mix. Consequently, composts with wood wastes tend to alternate between decomposition of the two polymers, with the temperature going up and down several times so that it generally takes two summers to mature a wood-based compost in Canada. The problem can be worsened if only sawdust is used with finfish wastes because both the wastes are highly biodegradable and dense so that the movement of air is difficult. If the compost is remixed and relaid, i.e. 'turned', the scarcity of oxygen is removed, but the loss of ammonia and evolution of odour exacerbated. More so, as in the study of Brinton and Seekins (1988), if another dense and alkaline material like wood ash is included in the mix.

Composting of fish wastes with wood wastes, particularly sawdust, therefore requires a long time, or repeated mixing and turning of the mixture that results in emanation of foul odours, loss of ammonia, and an increase in the cost of production of the compost. Partly due to the loss of ammonia, the wood-based fish waste composts tend to have poor nutritional value for plants. The compost prepared from fish byproducts and sawdust by Brinton and Seekins (1988) over a period of 200 days contained 1.35% N, 0.69% P and had a C/N ratio of 29.9 which would suggest that the compost would not be an immediate source of N to crops but would compete with plants for bioavailable N compounds in the soil. Also, the inevitably high decomposition of the composts towards a C/N ratio of near 10, will restrict the availability of oxygen for plant root respiration in a soil treated with the composts prepared by Brinton and Seekins (1988).

The Use of Peat, and the Passively Aerated Windrow System of Composting

My colleagues and I felt that properties of peat (Mathur and Farnham 1985) and its availability in most areas of commercial fisheries in North America make it to be an ideal medium for the composting of seafood wastes. The feasibility was examined in 1984 (Mathur et al, 1986). Combinations of wastes from cod filleting, cullings of snow crab meat extractions, and seaweeds, mixed with and enveloped in brown peat, were tested as compost formulations. No other materials were added. Each compost pile was constructed in the outline of a trapezoid with a base of 2 m x 3 m and a height of 1 m. The top plane was 2 m x 0.3 m. Each pile included two 3.3 m long horizontal pipes of 8 cm diameter with 2 rows of 1.2 cm holes on the top side only. Ends of the pipes were open to ambient air. The peat formed 40% of the volume of the windrows. The temperature gradient set by the heat generated by decomposition within the pile drew fresh air naturally through the pipes thus replenishing the oxygen used. The fibrous nature of the peat helped the natural biologically-driven aeration. The aerobic biodegradation obtained thermophillic range (45 to 65°C) within days even while the ambient temperatures were 4 to 10°C. The aerobic state was prevalent throughout the process so that neither H_2S nor other malordours were emanated. No liquid was exuded. Consequently, problems of flies, vermins and foul odour were avoided as the peat blanketed and deodorized the waste.

Virtually all the NH_3 generated by degradation was adsorbed by the moist, acidic peat. The sanitary, relatively biostable, hydrophilic and insulatory properties of the peat obviated the need for watering and turning of the composts. Peat itself did not support thermophilic activity, and being sanitary it did not have to be subjected to the sanitizing heat in the middle of the pile. The composting was completed within 8 to 12 weeks in the small size piles. The finished composts were free of aliphatic acids and compounds that suppress seed germination, that is they were mature. They were 5.9 to 6.5 in pH, earthy in odour, dark brown, granular, and contained 2.7 to 3.2% N, 0.8 to 1.6% $NH_4 + NO_3$-N, 3.6 to 5.2% total P_2O_5, 0.4 to 0.8% K_2O, and 72 to 80% organic matter. The composts were, therefore, of high quality. Nuclear Magnetic Resonance spectroscopy for C, N and P in the composts and starting materials confirmed the biomaturation of the product and absence of any fish lipids and chitins in the finished compost (Preston et al 1986).

Whereas the raw materials (cod racks, seaweeds, and crab scrap), and unfinished composts were found, through tests involving suckling mouse and tissue cultures of adrenal, ovarian, and kidney cells, to contain some toxic substances, no toxins assayed were present in the mature seafood waste composts (Mathur and Johnson, 1987). The finished composts were thus found to be hygienic.

The passively-aerated windrow system of composting seafood wastes with peat was extended to commercial scale production through collaborative studies by scientists from Agriculture Canada, University of Moncton, University of Maine, Lameque Peat Moss Inc. and others (Mathur et al 1988). Preliminary experiments with several configurations led to adoption of a system where a 20 cm thick layer of loose peat is used as base for a windrow of 3 m width and up to 25 meters length. The open-ended ventilation pipes (with holes on the top side only) are placed on the basal peat layer at 60 cm intervals across the length of the passive windrow. A mixture of peat with individual or combined seafood wastes is placed on the pipes to attain a height of about 90 cm and a top plane of 1.5 m width. At this stage, another series of pipes are placed across the width at 60 cm intervals at points above the gaps between the lower level of the ventilation pipes. Another 30 cm thick layer of the peat and the seafood waste mixture is deposited on top of the second row of pipes. The width of the top plane at this stage is about 35 cm. Finally the top and 4 sides of the windrow are enveloped by a 15 to 20 cm thick layer of peat. Overall, brown or blonde peat of about 65% moisture content by weight was generally 40% by volume of the windrow. About half of the peat used was in the base and envelope layer; the other half was within the mixture in the middle. The tests for commercial scale composting of seafood wastes involved residues from the processing of cod, flounder, redfish, sole, herrings from which only roe had been taken, crab, lobster and dogfish. Other trials involved shrimp and whole capelins. The study by Mathur et al, (1988) resulted in production of composts that contained up to 5.1% N, and up to 4.8% P_2O_5 as also most of the other bioessential elements.

Attention was also paid to the fact that commercial scale composting has to be profitable, without considering the saving of tipping fees. First thing to realize in this context is that the peat itself decomposes little but gains the nutrients from the seafood wastes almost passively so that the acidic nutrient-poor peat used is recovered as neutral and nutrient-rich peat. The peat compost is comparable to a peat that has been limed and fertilized with all bioessential elements for use in nurseries and greenhouses. Such value added peat is marketed at 1.7 to 2.5 times the price charged for peat itself. The cost of adding similar value to the peat by composting is only 10 to 30% of the cost of the peat. Also, the cost as percent of the product is even less as the peat used does not have to be the air-dry, milled and screened peat of the horticultural (blonde) grade. It can be the brown rough peat that is not in demand for either horticultural or fuel usage (Mathur et al 1986).

Another related issue is the harvesting of peat itself as it may entail destruction or perturbation of wetland ecosystem(s). The counter point here is the simple fact that after harvesting, cutover peat areas can be, and in many instances, such as in Ireland, have been restored to a natural state simply by systematic blockage of the drainage system. Thus all the conditions that promoted the accumulation of organic matter are nearly restituted. The peatlands are restored as sequesters of carbon, and thus to their natural role in the global carbon cycle. At the same time, all the peat removed does not necessarily mineralize to CO_2, nor do cutover peatlands have the same potential for producing and emitting methane. It is a relevant fact that methane is 25 times more forcing as a greenhouse gas than CO_2, on a per mole basis.

Indeed if the peat used in composting is applied to land it would contribute to soil humus and help reverse the present role of cultivated soils as sources of greenhouse CO_2 by restoration of organic matter to soils (Benzing-Purdie and Mathur, 1989).

Soil Degradation and Peat-Composts

The degradation of soils as the primary resource for Canadian Agriculture is the prime problem of the farm sector. The degradation decreases dependability of production by reducing the natural resiliency of the land base to stresses of moisture and heat, contributes to increases in purchased inputs, while the land is eroded mostly into water bodies where the organic matter in the soils may be decomposed anaerobically to produce CH_4 and N_2O.

The degradation of soil is always accompanied by, and often caused by, a loss of soil organic matter.

Cultivated soils in Canada now contain about half the organic matter they did in their natural state. The loss continues at 1% yearly of that remaining in the soil (Benzing-Purdie and Mathur 1989). Consequently the soils abilities to retain fertilizer nutrients and supply the same to plants from their organic content have declined. The loss of applied fertilizers may contribute to overburdening of global biogeochemical cycles and manifest itself as entrophication and degradation of groundwater quality. The loss of land applied nutrients would be greatly reduced if the nutrients were applied through composts rather than as readily water soluble fertilizers (Mathur et al, 1990b). At the same time the composts will help restore organic matter to soils, improve their fertility and tilth, thus having a positive impact on global warming, water quality, dependence on fossil fuels used for fertilizers and tillage, and help veer agriculture towards environmental sustainability.

The capacity of different materials to restore soil humus varies. If the relative capacity is taken as 1 for green manure the ratings for straw, farmyard manure, farm compost, and sawdust are 1.4, 2.4, 3.0 and 3.7 respectively. The corresponding figure for peat is about 8 making it more than 3 times more effective than farm yard manure.

The use of peat-based seafood waste composts would therefore avoid the pollution resulting from their disposal, restore soils as a sink for C, and ameliorate degraded soils with all the other attendant benefits.

It is therefore not surprising that the peat-based composting of seafood wastes is being practiced in Canada for commercial production of bagged composts aimed at the home gardening market, as well as by some farmers for bulk use, both employing the passively-aerated windrow system.

The same system is also effective in composting manure slurries bulked with peat (Mathur et al, 1988b, 1989, 1990a).

CONCLUSION

It is feasible to compost seafood wastes with peat at commercial scale by the novel passively aerated windrow system. This and the use of the resultant compost on land will help avoid certain pollution as well as ameliorate soils to which the compost is applied.

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AN ADDITION TO THE U.S. REGULATORY ALPHABET SOUP: TCLP REPLACES THE EP IN THE RCRA - TC RULE

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The Resource Conservation and Recovery Act (RCRA), Subtitle C Program is replete with acronyms, and recently a new one has been added. After a lengthy delay, the U.S. Environmental Protection Agency (EPA) finalized the "TC" (Toxicity Characteristics) rule (EPA 1990). This rule forms the basis for determining when a waste is considered hazardous by virtue of its toxic characteristic. The impact of the rule is anticipated to be quite substantial. Large volumes of waste are expected to be classified as newly hazardous waste. The TC rule identifies new constituents, whose presence in a waste can result in a regulatory designation as hazardous. In addition, the rule presents a new extraction procedure that must be used when analyzing for hazardous constituents, the Toxic Characteristic Leaching Procedure (TCLP).

EVOLUTION OF THE REVISED RULE

Within the RCRA hazardous waste program, there are two mechanisms for determining if wastes are hazardous. One is an evaluation conducted by EPA, resulting in wastes being designated as RCRA Listed waste and given a specific waste code, e.g., F002, K048. The second mechanism is a determination made by waste generators. Generators must decide if their wastes (i.e., those not already designated by EPA as Listed wastes) are Characteristic hazardous wastes, by either performing chemical analyses or simply by using their knowledge about chemical constituents common to the process generating the wastes.

In 1980, EPA developed a special extraction procedure (the EP test) to be used when analyzing wastes, and identified specific compounds for regulatory control. These compounds included eight metals, four insecticides, and two pesticides. Any waste extract containing one or more of these compounds in concentrations above specified regulatory levels were to be managed as Characteristic hazardous wastes.

As implementation of the EP test became widespread throughout the regulated community, much criticism about the procedure emerged. Two major concerns were expressed by government, public interest groups, and the regulated community. One was that the number of constituents for which the analysis was to be performed was not sufficient for protecting public health and the environment. The second concern was that the extraction procedure did not "catch" any organic chemicals that might be present in the wastes. These criticisms prompted the U.S. Congress to mandate, in the Hazardous and Solid Wastes Amendments (HSWA) of 1984, that EPA revise the EP procedure and expand the number of constituents to be regulated as hazardous. As a result of this mandate, the Agency proposed the TC rule in 1986. A final rule became effective on September 25, 1990.

SCOPE OF THE TC RULE

The intent of the TC rule is to identify those solid wastes that would threaten human health and the environment if improperly managed. The revised rule maintains the original focus on conditions within a municipal landfill, as a worse-case mismanagement scenario. The EPA had considered developing an approach based upon expected management practices for particular wastes. However, the revised rule emphasizes the Agency's belief that the most effective regulatory approach is a management scheme based on toxic properties of wastes and the impact of these wastes if mismanaged. Therefore, the TCLP is designed to mimic those conditions in a municipal landfill that would enhance the potential leachability of hazardous constituents.

The model used by the Agency to establish regulatory levels for each constituent continues to focus on groundwater contamination. EPA does have the statutory authority to expand the scope of this model to other environmental media. However, the Agency believes that currently there is insufficient information and data with which to develop models for a broader range of potential contamination, for example, air and surface water.

The new constituents included in the revised rule are all nondegrading or minimally degrading compounds. The regulatory levels are derived using health-based data and a dilution/attenuation factor (DAF) of 100. Whenever possible the Agency based the regulatory levels on existing maximum concentration levels (MCL) developed in the EPA Drinking Water Program. When MCLs were not available, regulatory levels were set at a risk level of 1 in 100,000 or 10^{-5}.

The DAF used in the groundwater model represents a reduction in concentration that would be expected during constituent migration from the bottom of a disposal unit through an unsaturated zone and through a groundwater source (i.e, the saturated zone) to a drinking water source (e.g., drinking water well). Many other factors, such as potential dispersion in all directions, one-dimensional and uniform advective flow, adsorption and chemical degradation from hydrolysis, were also considered in the model.

The Agency did not make any changes in generator requirements for identifying Characteristic hazardous wastes. As the first rule established in 1980, a generator is responsible for this determination, based either upon knowledge of the composition of the waste or by applying the TCLP and chemically analyzing the extract. The decision about the hazardous nature of a waste continues to be made at its point of generation.

REGULATORY LEVELS FOR SPECIFIC CONSTITUENTS

The constituents included in this rule and their regulatory levels are presented in Table 1. The regulatory concentrations identified for the original EP compounds have not been changed in this revised rule, and are incorporated in Table 1. These constituents include:

- Arsenic
- Cadmium
- 2,4-D
- Lead
- Mercury
- Selenium
- Toxaphene
- Barium
- Chromium
- Endrin
- Lindane
- Methoxychlor
- Silver
- 2,4,5-TP (Silvex)

Although the regulatory levels for these compounds were developed using the EP, it is now necessary to obtain waste extracts using the TCLP for all of them.

SUMMARY OF TCLP METHOD

The TCLP is designed to determine the mobility of both organic and inorganic constituents that may be present in liquid, solid, and multiphasic waste. The TCLP is promulgated in Appendix II to 40 CFR, Part 261. The EPA has designated this procedure as Method 1311, and will incorporate it in Test Methods for Evaluating Solid Waste Physical Chemical Methods -- SW-846 (SW-846 1986).

If results from a total analysis of a waste indicate that the constituents in Table 1 are not present, or are at concentrations below the regulatory level, then no further analysis with the TCLP is necessary. If any liquid fraction of a waste contains constituents above these regulatory levels, the waste is considered a

TABLE 1. TC CONSTITUENTS AND REGULATORY LEVELS

Constituent	Regulatory Level (mg/l)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol	200.0
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor (and its hydroxide)	0.008
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2

Characteristic hazardous waste and no further analysis of any solid portion is necessary.

A flowchart for the method is illustrated in Figure 1. Two possible TCLP extracts are defined in this flowchart. One definition is for liquid wastes (Point A on the flowchart). For wastes containing less than 0.5 percent dry solid material, the TCLP extract is the liquid resulting from filtration.

The second definition represents those wastes with solids at 0.5 percent or greater (Point B on the flowchart). Liquid and solid phases must be separated, and solids reduced in particle size, if necessary. The solid phase is extracted with a fluid equal to 20 times its weight. If volatile compounds are present, a Zero Head Extractor (ZHE) must be used. Following extraction of the solids, the liquid is once again filtered and combined with the liquid from the first separation step, if compatible. This combined liquid is then analyzed to determine concentrations of TC constituents. If the two liquid phases are not compatible, they must be analyzed separately.

COMPARISON OF EP AND TCLP

Several differences exist between the EP and the TCLP (HWC 1989). These differences include the following items:

Extraction Fluid

- EP: 0.5 N acetic acid, added to water to a pH of 5,
- TCLP: 0.1 N acetic acid to water to a pH of 2.88 for alkaline wastes; 0.1N acetate buffer to water to pH 4.9 for others.

Liquid/solid Separation

- EP: 0.45 μm filtration to 75 psi,
- TCLP: 0.6 - 0.8 μm glass-fiber filter filtration to 50 psi.

Particle Size Reduction

- EP: Structural integrity procedure, or grinding and milling,
- TCLP: Crushing, cutting, or grinding and milling only.

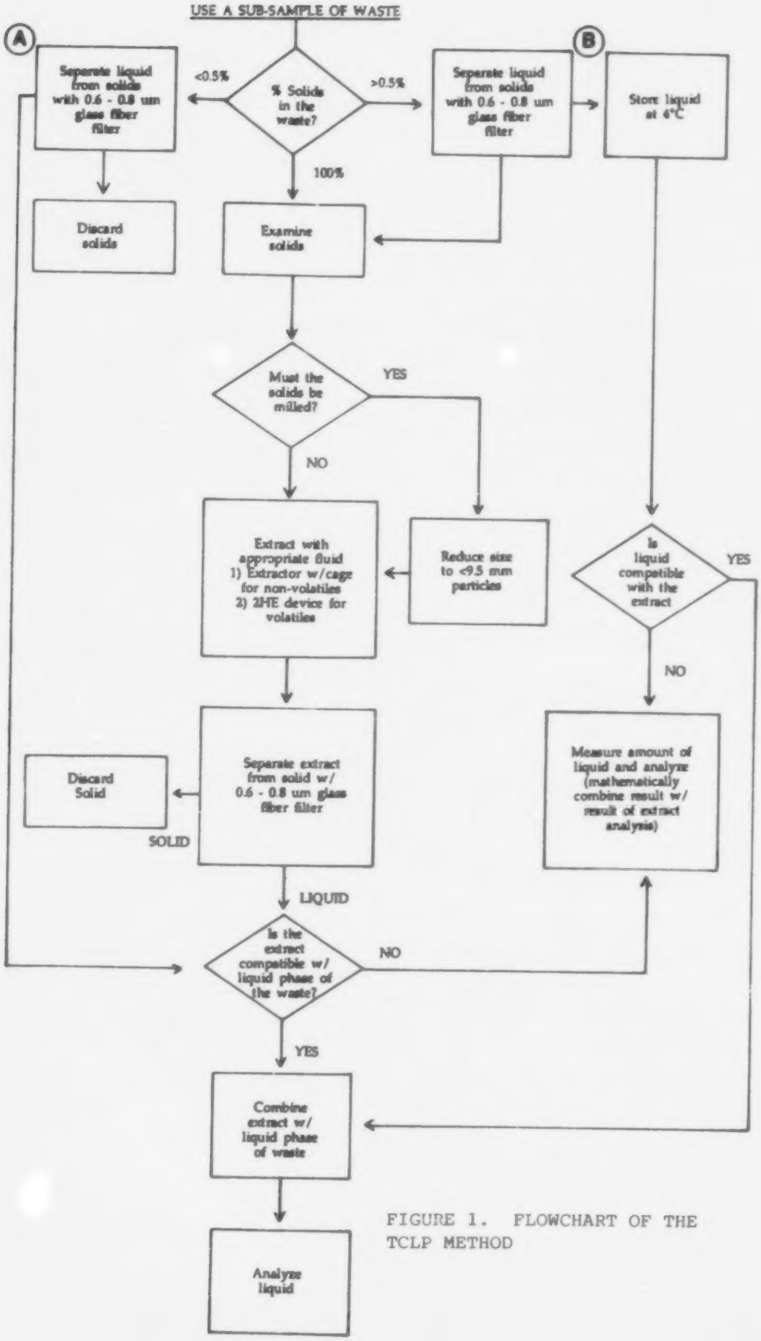
USE A SUB-SAMPLE OF WASTE
A
B
Separate liquid from solids with 0.6 - 0.8 um glass fiber filter
<0.5%
% Solids in the waste?
>0.5%
Separate liquid from solids with 0.6 - 0.8 um glass fiber filter
Store liquid at 4°C
100%
Discard solids
Examine solids
Must the solids be milled?
YES
NO
Extract with appropriate fluid 1) Extractor w/cage for non-volatiles 2) ZHE device for volatiles
Reduce size to <9.5 mm particles
Is liquid compatible with the extract
YES
NO
Discard Solid
SOLID
Separate extract from solid w/ 0.6 - 0.8 um glass fiber filter
Measure amount of liquid and analyze (mathematically combine result w/ result of extract analysis)
LIQUID
Is the extract compatible w/ liquid phase of the waste?
NO
YES
Combine extract w/ liquid phase of waste
Analyze liquid

FIGURE 1. FLOWCHART OF THE TCLP METHOD

Agitation

- EP: Narrative description of acceptable agitation, no specifications provided,
- TCLP: Rotation in an end-over-end manner at 30 ± 2 rpm.

Extraction Time

- EP: 24 hours,
- TCLP: 18 ± 2 hours.

Quality Assurance Requirements

- EP: Standard additions, one blank per sample batch.
- TCLP: Some standard additions required, one blank per 10 extractions conducted in an extraction vessel.

Although the TCLP is considered an improvement over the EP, problems have been identified by those in the regulated community faced with using the method. These problems include matrix interferences, difficulties with the ZHE, and higher costs associated with use of this method.

IMPACT ON REGULATORY PROGRAMS

This rule will have far reaching impacts, not only for new industries brought within the Subtitle C jurisdiction, but also in its application to other parts of RCRA and other environmental laws. Although the TCLP was developed as an extraction methodology for determining if wastes are hazardous when mismanaged, the Agency has decided to use the TCLP as the general extraction procedure in a variety of different programs.

Even though the TCLP methodology remains the same among different programs, the regulatory levels to be met in each program can vary drastically. For example, there are three separate programs within RCRA to which the TCLP will be applied. These are the Land Disposal Restrictions (LDR) Program, the Delisting Program, and the Underground Storage Tank (UST) Program. In each, the constituents of interest will be extracted from wastes, treatment residues or contaminated soils using the TCLP. However, the standards that must be met for individual constituents vary among these programs. Table 2 illustrates these differences.

The reason for these differences is the basis for developing each standard. Regulatory levels established for the LDR Program are based on technological capability; those established for delisting purposes and the TC rule are health-based standards. Yet, even when two programs use the same basis (e.g., health effects data), different standards are derived, as illustrated in Table 2 for the Delisting and TC standards.

The TCLP also will be required in other regulatory programs. For example, in the Superfund Program, authorized by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the TCLP and subsequent chemical analyses will be applied to determine the regulatory status of soil and debris generated from a cleanup activity, i.e., are the soil and debris Characteristic hazardous wastes? If these materials "fail" the test, they must be handled as Subtitle C wastes.

INDUSTRIES IMPACTED BY THE RULE

Because of the greater extraction efficiency of the TCLP, in particular when extracting organics, the number of industries that potentially will now be generating newly hazardous wastes could increase substantially. EPA estimates that 15,000 to 17,000 generators will be impacted by the TC rule. Figure 2 illustrates these affected industrial sectors. The volume of wastes expected to "fail" the TCLP is estimated at 730 million metric tons of wastewater (two times the current total annual generation of hazardous wastes in the United States) and 0.85 to 1.8 million metric tons of non-wastewater, i.e., solid hazardous wastes. The major constituents driving the hazardous designations include:

- 60 percent due to the presence of benzene,
- 25 percent are expected to be wastes containing chloroform,
- the presence of vinyl chloride represents an anticipated 17 percent of the total volume, and
- 15 percent could contain trichloroethylene.

EPA presumes that most of the large volume of wastewater (the 730 million metric tons) actually will be exempt from RCRA, Subtitle C control. Current regulations in the Subtitle C program exempt those wastewaters

TABLE 2. CONFLICTING REGULATORY THRESHOLDS IN RCRA
(values in mg/l)

Constituents	LDR	Delisting	TC
Cadmium	.006*	.001	1.0
Lead	.180**	.05	5.0
1,2-Dichloroethane	.007	.005	.5

* in F006 nonwastewater
** in K046 nonwastewater

FIGURE 2. INDUSTRIES POTENTIALLY IMPACTED

Textile Mills
Lumber and Wood Products
Pulp and Paper
Printing and Publishing
Synthetic Rubber
Plastics Materials/Resins
Synthetic Fibers
Pharmaceutical
Organic Chemicals
Plastics Products
Petroleum Refining
Electrical Services
Miscellaneous Petroleum and Coal
Rubber and Miscellaneous Products
Machinery and Mechanical Products
Pipelines, except Natural Gas
Wholesale Petroleum Marketing

that are treated in tanks. Because of this exemption, the Agency anticipates that anyone presently managing these wastewaters in surface impoundments will shift management practices to incorporate treatment in tanks thus, taking advantage of this exemption. Therefore, the Agency believes that this enormous amount of newly hazardous wastes will not create management capacity shortfalls at RCRA Subtitle C permitted facilities.

COST OF COMPLIANCE

Compliance costs associated with the TC rule are envisioned to be quite high. EPA estimates range from $1.9 billion to $6 billion (calculated at present value). Ninety-five percent of these compliance costs are associated with non-wastewater, i.e., management needs for solids and sludges. Should EPA's prediction that the majority of the newly hazardous wastewater volumes will be exempt prove inaccurate, these compliance costs will be even greater.

Such high compliance costs could have adverse impacts on product development and capital investments for many U.S. manufacturers. Many companies most severely impacted by the application of the TC rule are those that produce primarily intermediate goods. Goods used as feedstock in other industrial processes, not goods considered as a final consumer product. Therefore, such companies will find it difficult to pass along the cost of compliance.

The inability to pass on high compliance costs could place these industries at a competitive disadvantage. Substitutes for their goods might be available from other domestic industrial sectors not yet subject to this rule and certainly could be available from foreign suppliers.

CONCLUSION

Few persons in government, public interest groups and even in the regulated community can dispute the need for the newly revised TC rule. By expanding the number of constituents considered hazardous and by incorporating a more efficient extraction procedure, a greater amount of hazardous wastes will receive proper care from cradle to grave. Continued effort will be needed, however, to improve the TCLP methodology and to reduce the confusion generated by applying this extraction procedure in widely divergent programs with very different regulatory standards. The appropriateness of applying the TCLP as the method by which regulatory compliance is verified remains a controversial issue.

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SUMMARY

THE ROLE OF LEACHATE EXTRACTION IN WASTE CHARACTERIZATION IN CANADA

This paper will present the Canadian perspective for the regulation of wastes that generate toxic leachates when disposed. By definition, any waste which is leachate toxic will be considered a hazardous waste for purposes of management, transport and disposal. This designation is based on the need to protect groundwater supplies from indiscriminate disposal of hazardous wastes in landfills designed for domestic waste disposal

Initial regulatory controls at the national level were inaugurated by the inclusion of "waste" in the Transportation of Dangerous Goods (TDG) Regulations in 1985. In 1989, the definition of waste was extended to include a list of 30 chemicals which, when detected at specified concentrations after an appropriate extraction process, are to be designated as constituents of "leachable toxic waste". This "appropriate extraction process" is specified in the TDG Regulations as CGSB 164-GP-1 MP and essentially parallels the EP system used in Ontario and previously by the USEPA.

Under the auspices of the Canadian Council of Ministers of the Environment, a cooperative study was initiated by the Hazardous Waste Working Group to develop a Canadian Extraction Procedure. While further work is required, the validated extraction procedure will replace the procedure now specified in the TDGR. Furthermore, the list of extractable constituents will be extended, based initially, on the revised Canadian Drinking Water Guidelines of 1989 and, secondly, on an extensive review of the dangerous goods listed in the TDGR. Environment Canada has, at present, completed reviews of about 900 of the 1500 pure compounds listed in the Schedule to TDGR.

A summary of the hierarchy of waste classification will show how a waste generator proceeds from designation of a waste dangerous good in concentrated form through to dilute wastes and ultimately to leachable toxic waste.

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AN INTERNATIONAL PERSPECTIVE ON ASH FROM MUNICIPAL WASTE INCINERATORS

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INTRODUCTION

Most municipalities in North America now face the difficult problem of managing the ever growing volume of municipal solid waste (MSW) in an environmentally acceptable manner. While an integrated strategy of utilizing the "4-R's" is regarded as the most efficient and cost effective means of reducing the volumes of MSW requiring landfill, environmental groups have been reluctant to endorse the use of all four "R's". Thus, an over-emphasis on recycling and firm opposition to MSW incineration have resulted in a continued reliance on landfill.

Historically, public opposition to the siting and operation of MSW incinerators has been based on concerns over emissions of contaminants to the atmosphere. During the late seventies and early eighties, much of this concern was justifiable in light of the poor performance of inadequately designed and operated facilities. In addition, the ability of scientists to detect trace contaminants at very low concentrations placed further pressure on the industry to reduce emissions.

During the last decade, the industry has responded positively. Most of the concerns related to emissions have been addressed by optimizing incinerator design and operation to improve combustion control. This and the implementation of new air pollution control technologies has dramatically reduced atmospheric emissions. The advent of more efficient incinerator operation and better designed air pollution control systems has resulted in concern shifting from air emissions to the disposal of the captured residues. Today, ash disposal is one of the major issues limiting the acceptance of new incinerator facilities.

The Incinerator Ash Issue

In North America, the major concern over incinerator ash centres on the potential for human exposure to contaminants, specifically toxic metals in the ash. Exposure can occur either through the inhalation of fugitive dust or the ingestion of contaminated groundwater. While the industry is moving to address these issues, environmental groups continue to push for more stringent regulations for the disposal of the residues. Several factors are contributing to this situation:

- o Residue sampling and analytical protocols have not been well established, thereby compounding the variability of the data;
- o The inherent variability of ash characteristics results in often contradictory laboratory results;
- o Different combustion technologies and air pollution control systems produce additional variations in the data base;
- o Because the issue of potential groundwater contamination through improper ash disposal was considered minor for many years, cursory studies provided an inadequate data base;
- o In addition to immediate environmental impacts, the management of these residues must consider the contentious issue of potential long-term effects.

All of these factors contributed to a highly fragmented data base which in turn has resulted in much confusion and the propagation of many misconceptions. In light of these problems, several individuals actively involved with ash research were prompted to suggest that the global data base needed to be compiled, reviewed and critically evaluated in order to clarify the issues.

In April of 1989, a proposal entitled "MUNICIPAL WASTE INCINERATION: AN INTERNATIONAL PERSPECTIVE ON THE CHARACTERISTICS, DISPOSAL, TREATMENT and UTILIZATION OF RESIDUALS" was submitted to an Expert Working Group of the International Energy Agency (IEA) for consideration. The proposal involved the development of a treatise on the state-of-knowledge concerning MSW incinerator residues through the establishment of an International Ash Working Group (IAWG).

OBJECTIVES

Within the overall purpose of putting the ash issue into proper perspective by providing a compilation of existing knowledge concerning MSW incinerator residues, the project has some specific objectives.

1. Definition of uniform protocols for sampling and characterization (including defining chemical, physical, and leaching properties) of incinerator residues;

2. Compilation of a data base after critical evaluation of the quality of the data;

3. Evaluation of disposal, utilization and recovery practices as currently employed, researched or postulated by various authorities in the field;

4. Preparation of a summary and a critique of existing management and control initiatives;

5. Recommendations for research priorities to enable solutions to be identified in a timely manner.

Benefits

The IAWG believes that by achieving these objectives, the project will provide many benefits for the public, academia, government and industry.

1. By defining a set of uniform protocols and critiquing existing protocols, researchers and regulators throughout the world will be able to compare and contrast their data to that of others. It will also generate comparable data at a rate greater than that currently being experienced.

2. By assembing the data concerning the physical and chemical characteristics of residues, and the potential variations that other factors impart on the residues (such as different incineration technologies), researchers and regulators will be better able to focus on areas requiring special attention.

3. By describing the potential environmental performance of of various disposal, utilization or recovery practices, regulators, the industry and the public will be better able to assess and select the most appropriate option for their situation.

4. By critiquing existing regulatory and management options, and providing a fundamental rationale for regulations covering the management of MSW incinerator residues, regulators and the public will be better able to develop common standards for all jurisdictions.

5. By identifying new areas of concern, research can be "fast-tracked" thereby enhancing assessment of preferred management options.

6. By compiling the state-of-knowledge on ash, it is hoped that many of the misconceptions over the potential environmental impacts of ash can be laid to rest.

APPROACH

A select group of researchers in the field of MSW incinerator ash has been assembled to develop the state-of-knowledge treatise. The IAWG is comprised of individuals from Canada, Denmark, Germany, the Netherlands, Sweden and the United States and is operating under the aegis of the IEA. The IAWG will operate by meeting at regular intervals throughout the three year project to discuss selected topics. The timetable and topics are summarized in Table 1.

Preparation for each meeting will involve each member assembling and familiarizing themselves with any documentation relevant to the specific topic of discussion. It is the Group's intention to compile a list of key points during each meeting and use that list as a basic outline for the development of draft chapters by the group's technical editor. Each draft chapter will be reviewed by the group prior to submitting the drafts to each of the sponsoring agencies for review and comment. In addition to the efforts of the individual members, the group will be consulting with other researchers in the field to ensure that the broadest range of perspectives are considered in the development of the final document. The final document will also be subjected to a peer review to maintain its objectivity.

Funding

Funding for the project is being sought from a large number of international organizations and agencies. The original concept of the project was to have 18 to 20 sponsors world-wide, each contributing an equal portion of the total project costs. This was done to maintain the integrity of the project.

Table 1. Summary of Meeting Dates and Topics of Discussion

Date	TOPICS
February 1990	Technology Description Sampling and Analytical Protocols
May 1990	Waste/Residue Characterization - Chemical/Physical
August 1990	Leaching Phenomena and Fundamentals
November 1990	Evaluation of Laboratory and Field Data
March 1991	Vitrification, Solidification, Recovery Potential
June 1991	Utilization, Product Testing and Disposal
August 1991	Source Separation, In-plant and Transportation Handling Issues
November 1991	Bioavailability, Long-Term Behaviour
February 1992	Integrate data sets Pilot/Laboratory/Field
May 1992	Integration of Subjects into Draft
August 1992	Final Draft Review

To date the IAWG has signed agreements with the following organizations/agencies:

- the Office of Waste Management - Environment Canada
- the United States Environmental Protection Agency
- the Swedish Energy Agency
- the Netherlands Agency for Energy and the Environment
- the Institute for Resource Recovery
- Wheelabrator Environmental Systems Inc.

Agreements are currently being negotiated with the following organizations/agencies:

- Energy, Mines and Resources Canada

- o the United Kingdom Department of the Environment
- o the Danish Ministry of Energy
- o the Kernfornschungzentrum Karlsruhe - Germany
- o the American Society of Mechanical Engineers
- o the New Jersey Department of the Environment
- o LAB - France
- o the Greater Vancouver Regional District

Although a large portion of the estimated budget has been realized, the Group is continuing to solicit funds from other organizations to meet the total budget requirements.

Recognizing that the sponsoring agencies require information from the three year project in a timely manner, the Group is distributing minutes of the meetings to the various sponsors and providing them with draft chapters as they are completed for review and comment. Final revised versions of the chapters will alos be distributed as they are completed.

PROJECT UPDATE

The IAWG project commenced with the first meeting held at the Environment Canada offices in Ottawa, Ontario, in February of 1990. A second meeting was held in May at the Laboratorium fur Isotopentechnik in Karlsruhe, Germany.

The first meeting was devoted to discussing technology descriptions, sampling methods and analytical protocols. Technology descriptions focused primarily on the three major types of incinerators including mass burning facilities, two-stage combustion units and refuse derived fuel combustion systems. Different sampling and analytical protocols currently in use were compared to provide both an understanding of the limitations of each method and to develop the most appropriate comprehensive protocol for all systems.

The second meeting was devoted to describing the physical and chemical characteristics of the various ash streams. These characterisitics were described with particular attention to particle size distribution, loss on ignition, inorganic contaminant concentrations and acid nuetralization capacity.

Although the group's intention was to compile a global data base, the first two meetings have made it clear that the considerable ash related research which has been conducted over the last two to three years will preclude an exhaustive critique of all available studies. It has been decided that the most appropriate format for the document to take would be to illustrate pertinent trends by making extensive use of case study material. This process is currently underway as several draft chapters have been written and distributed for review and comment.

It is anticipated that the final document will be approved during the Fall of 1992. After distributing the document to the sponsoring agencies, the document will be published for release to the public.

Leachability of Bottom Ash from a Municipal Waste Incinerator

Julia Stegemann, Wastewater Technology Centre,
Environment Canada, Burlington, Ontario

See page 347
Voir page 347

Waste Composition Study

Paul Kaldjian, U.S. Environmental Protection Agency
Washington, DC

Paper unavailabel at time of printing
Texte non reçu au moment de mettre sous presse

Hydrogeological Investigations at Come-by-Chance Refinery Waste Site

Steve Graham, Nolan, Davis & Associates
St. John's, Newfoundland

Paper unavailable at time of printing
Texte non reçu au moment de mettre sous presse

FEDERAL WASTE MANAGEMENT PROGRAM

by

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One of the greatest challenges that Canadians face in placing their country on the road to a sustainable future is reducing the volume of waste that they generate. Waste management is indeed an urgent and pressing problem in Canada.

Each year Canadians generate 35 to 40 million tonnes of waste, of which about 30 million tonnes are non-hazardous wastes. Overall, Canadians spend 1.5 billion per year on waste management.

In 1989, on a per capita basis, Canada produced more waste in the domestic, commercial and light industrial sectors combined than any other country in the world, that is 1.7 kg per person per day. In addition, our efforts to reduce, reuse and recover the resources that we are discarding also fell short of all other countries in the world.

Canadians realize that this situation is unacceptable and they are demanding that their governments take action. The success of community-based blue box recycling programs is evidence of the willingness of individual Canadians to choose and to support a sustainable future. Similar efforts have been initiated in the industrial and commercial sectors of our economy. For example, the Canadian Waste Exchange in Toronto encourages trade of materials among industries to reduce the amount of wastes for disposal. The federal government is committed to working in partnership with Canadians to achieve this goal.

The Canadian government approach to the minimization of wastes is based on the 4 R's: reduction, reuse, recycling and recovery.

Reduction activities aim at minimizing the generation of wastes at the source by substituting products which are less wasteful, by redesigning packaging and products, and utilizing processes which are less wasteful. Procter & Gamble's Enviro-Pack is a good example of reduction. The new refill pouches use 70% less plastic material than the rigid detergent bottles.

The Reuse principle may involve washing and/or relabelling of the original container, or it may also simply be reused again. Packages and containers may be reused for the same purpose or a different purpose the second time around. Beer bottles have been a very successful example of container reuse. Some bottlers have achieved as much as 95% reuse of their bottles (up to 20 times for a bottle). In the industrial sector wood pallets are commonly reused a number of times. Solvents used in high-tech industries, which cannot be reused in the same processes, are often sold to paint companies.

Recycling activities can now be found in all sectors of the economy. Examples of materials being recycled include, scrap cars, newsprint and fine paper, waste oils, industrial slag for recovery of precious metals and domestic garbage such as aluminum cans and glass containers. Recycling is receiving increasing attention with the success of many programs such as the widespread municipal curbside collections. More market development strategies are now needed to ensure that industry can utilize the recovered materials to the largest extent possible.

The recently formed Canadian Polystyrene Recycling Association has been mandated to look at developing facilities, on a national basis, for recycling products manufactured from polystyrene plastics. Environment Canada is also working with the Canadian Rubber Association to encourage the recycling and reuse of scrap tires. Furthermore, through programs such as the Environmental Choice Program, we are working to educate consumers and promote markets for recycled products. This program is currently establishing product categories and guidelines for products containing recycled materials thereby promoting their market development.

Recovery: The waste tire issue provides an example of why we must develop a "cradle to grave" approach to deal with our waste management crisis.

Overall, waste tires represent 1.5% of the total municipal waste stream. In Canada, the equivalent of approximately 24 million tires is disposed of each year, of which only 5 million (20%) are recycled or reused. This waste stream presents a unique opportunity for energy recovery through incineration in, for example cement kilns. The use of alternate fuels such as waste tires and even PCB contaminated oils can be a viable, environmentally sound, (albeit short term) option, by conserving non-renewable resources such as oil, coal and natural gas.

The Federal Approach to Waste Management

The federal government's approach to waste management is an integrated one based on the 4Rs. For the reminder of my talk, I would like to present an overview of our involvement in waste management.

Last December, a Waste Management Branch was created within Environment Canada to coordinate the growing involvement of the federal government in waste management activities. This was in direct response to rising public concerns and awareness about the state of our environment, especially waste generation. The Branch's activities are focused around four main areas of responsibility:

1) the Hazardous Waste Management Division;
2) the Office of Waste Management;
3) the Contaminated Sites Program;
4) the Federal PCB Destruction Program.

Hazardous Waste Management

The mandate of the Hazardous Waste Management division can be summarized in four basic points:

1) to ensure that generation at source is reduced to a minimum;

2) to dispose, as much as possible, of Canadian hazardous wastes within Canada;

3) to establish an enhanced system for hazardous waste exports and imports;

4) to cooperate in the exchange of information, technology transfer and harmonization of standards, guidelines and codes.

Our focus is twofold: on the one side, we are working to harmonize federal and provincial regulations and guidelines so that hazardous wastes in Canada are managed in an environmentally sound manner. At the international level, Canada as a modern, industrialized society, must be responsible within a global context for the hazardous wastes it generates. Nationally, the Canadian Council of Ministers of the Environment (CCME) plays a key role in ensuring a streamlined approach to hazardous waste management. Internationally, organizations such as the United Nations Environmental Program (UNEP) and the Organization for Economic Cooperation and Development (OECD) are playing an important role in influencing the decisions being made.

For example, Canada has been participating in the OECD environment program since the early 1970's. In 1985, OECD started work on an agreement to control transboundary movement of hazardous wastes between OECD countries and non-OECD countries. Meetings began in 1987 and culminated in a diplomatic conference held on March 1989 in Basel, Switzerland.

Canada signed this Convention in March 1989 along with 33 other countries. As of March 1990, the deadline for signing, a total of 56 countries had signed the Convention. Signatories have agreed that they intend to ratify the convention at a later date when regulations have been developed to implement the requirements of the Convention. In order for the Convention to be in force, 20 countries must ratify the Convention. Canada intends to be one of the first 20. Accordingly, Canada is now developing its Regulations Respecting the Import and Export of Hazardous Wastes under the Canadian Environmental Protection Act (CEPA). We expect to have these regulations in place by early 1991. The goal of the import/export regulations is to manage the transboundary movement of hazardous wastes into and out of Canada and to allow Canada to meet its international commitments under the Basel Convention.

The consultation process on the import/export regulations is continuing. I feel confident that we will be able to agree on a regulation that will reflect the concerns of most of the stakeholders.

A regulation banning all overseas export of PCB wastes came into effect on August 1, 1990. As a result of this ban under the Canadian Environmental Protection Act, all possessors of PCB wastes must store or destroy the waste in compliance with PCB treatment and storage requirements. An interim order under CEPA, in effect since September 1988, stipulated that PCB wastes must be stored under conditions that do not pose any threat to the environment or to human health.

On June 3, 1989, an interim order was issued under CEPA to prohibit the import of contaminated fuel into Canada, except for the purpose of destruction, disposal or recycling of the fuel. Export of contaminated fuel is prohibited unless authorized by the government of the importing country.

Office of Waste Management

The Office is active in a number of areas, for example:

1) the National Packaging Protocol;

2) NITEP - the National Incinerator Testing and Evaluation Program;

3) involvement in the recent CCME used tire initiative;

4) recycling matters including various paper, plastics, metal and glass disposal issues.

In order to meet the challenge of waste reduction and minimization, CCME commissioned a National Task Force on Packaging in May 1989 to develop national policies and programs aimed at reducing the volume of packaging in the waste stream. Environment Canada coordinated the work of the multi-stakeholder Task Force composed of members from government, the manufacturing, shipping and retail sectors of industry, as well as environmental and consumer organizations. The product of this Task Force was a National Packaging Protocol, which was approved by CCME Ministers in March 1990.

The Protocol sets out six policy statements with supporting actions, establishes three packaging waste reduction milestone targets and puts forth two implementation recommendations.

Canada's National packaging Protocol will be implemented by a broad range of actions that will address the many facets of packaging issues. An implementation action plan has been developed and work has already begun to meet the management goals and waste reduction target of 50% reduction in packaging waste by the year 2000. This is obviously going to take an enormous effort by industries, consumers and governments.

Contaminated Sites Program

There are an estimated 1000 high priority contaminated land sites in Canada. These sites often pose multifaceted health and environment problems; they can impact on all components of the environment, particularly surface waters, soils and groundwater. Contaminated sites may include industrial production areas, landfills, waste storage and treatment sites and they may be located in residential, commercial, industrial, rural, urban or wilderness areas.

In April 1989, CCME recognized the need for a consistent national approach, based on the "polluter-pays" principle, for the ranking and cleanup of contaminated sites in Canada. They also recognized the need to provide government funds to cleanup high priority contaminated sites where the responsible party or owner cannot be identified or is financially unable to pay for cleanup, and to stimulate the development of new and innovative technologies.

In response to those needs, CCME established the National Contaminated Sites Cleanup Program (NCSCP). In October 1989, they announced the establishment of a $250 million 5-year program based on a 50/50 federal/provincial cost-sharing formula, to cleanup high priority "orphan" contaminated sites. The program will provide $200 million for cleanup activities and $50 million for cleanup technology development and demonstration.

At the federal level the program will be managed by Environment Canada in consultation with Health and Welfare Canada.

Federal PCB Destruction Program

The federal government is working to address the PCB problem in Canada through the Federal PCB Destruction program which was announced in 1988.

The federal commitment in the fall of 1988, which was the foundation for the present federal program, focused on the leasing of a transportable incinerator to destroy about 3500 tonnes of PCB-contaminated soil at Canadian Forces Base - Goose Bay, Labrador, leasing of a second incinerator in central Canada to destroy other PCB wastes, and decontamination of low-level PCB-contaminated mineral oil in the federal inventory.

In October 1989, the federal Minister of the Environment updated this commitment, to offer mobile or transportable incinerators to our regions of Canada with sufficient volumes of PCB wastes, that request federal assistance. These mobile facilities would be available to owners of PCBs (whether public or private) on a cost recovery basis. It must be recognized, however, that real success in ridding Canada of PCBs requires that communities accept the siting of these destruction facilities on a temporary basis. Yesterday you had an opportunity to hear Stephanie Hunt discuss federal experience with the PCB destruction facility siting process.

Federal Mobile PCB Treatment and Destruction Regulations, which came into effect under CEPA on January 3, 1990, govern the safe operation of PCB incinerators. To operate a PCB incinerator in Canada on federal land or under contract to a federal department or agency, incinerator operators must demonstrate that they can meet federal regulatory requirements. Since October '89, the program has focused on the testing of a smaller mobile incinerator (the Vesta 100), to determine if such a unit is capable of meeting Canadian regulatory requirements for PCB destruction. The successful operation of a larger transportable PCB incinerator at Goose Bay, Labrador, which has been described by other speakers earlier in the program, should help to convince other communities that PCB incinerators can be operated safely.

Since October 1988, over 70% of the federal low-level, PCB-contaminated mineral oil inventory has been decontaminated. Environment Canada continues to work with Public Works Canada on the "piggy-back" program, designed to make use of existing private sector contracts for decontamination of federally-owned, PCB contaminated mineral oil.

In the long-term, however, the federal government remains committed to encouraging the siting of permanent integrated hazardous waste treatment facilities, as part of the long-term solution to Canada's hazardous waste problem.

Finally, I would like to mention that the federal Chlorobiphenyl Regulations, originally enacted under the former Environmental Contaminants Act, are in the process of being reviewed and revised. Since February 1989, the original regulations have been in effect as an interim order under CEPA. Current timing suggests that the revised regulations will be introduced in the Canada Gazette, Part I, late in 1990. The regulations pertain to the manufacture, sale, use and release of PCBs to the environment in Canada.

Summary

I hope that over the last half-hour that I have been able to capture for you the essence of the federal government's commitment to the broad concept of environmentally sustainable economic development, and specifically the proper management of Canada's wastes.

Overview of Provincial Waste Management Legislations

Darrell Hynick, CCME Waste Committee
Toronto, Ontario

Paper unavailable at time of printing
Texte non reçu au moment de mettre sous presse

Overview of U.S. Waste Initiatives

Sheila Tooze, Canadian Embassy
Washington, DC

Paper unavailable at time of printing
Texte non reçu au moment de mettre sous presse

DEVELOPMENT OF A WASTE MANAGEMENT SYSTEM ASSESSMENT PROGRAM

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BACKGROUND

The proper handling, treatment and disposal of waste generated by industry, is an increasing concern for companies operating in Canada. Recent developments, as they relate to site cleanups, clearly indicate that waste generators must be cognizant of how their waste is being managed as it moves from point of generation through to disposal. The "superfund" experience in the United States, has shown that liabilities associated with waste may be retained for many years, even if materials have been shipped to a government approved operation. In addition, contaminant releases by a third party that has been contracted for waste management services, may adversely affect a company's public image, whether or not that company's waste is directly involved. Also, it has become apparent that sole reliance on government approval for selection of waste services/facilities is no longer acceptable. Consequently, the onus is on individual companies to minimize the liability associated with their waste management programs.

An assessment of all waste services/facilities that are utilized by a company, is one approach that may be implemented to minimize liability. Only those services/facilities deemed acceptable for use after an assessment, would then be retained.

The purpose of this paper is to present a methodology which may be used by a company to assess the capabilities of waste services/facilities. The methodology presented is based on the findings of a 1990 Canadian Petroleum Association (CPA) study entitled "Waste Management System Assessment Program".

WASTE MANAGEMENT SYSTEM ASSESSMENT PROGRAM

To be effective, the waste management system assessment program must be able to:

- determine if waste services/facilities are in compliance with regulatory requirements;
- determine if these waste services/facilities comply with generally accepted standards of environmental practice that may not be required at present by statute; and
- assess the capabilities of waste services/facilities to prevent or limit environmental concerns and ultimately a company's own liability.

At the conclusion of the assessment process, company personnel should be able to select with confidence, who to use and where to send waste for storage, collection, transportation, treatment or disposal.

The waste management system assessment program developed in the CPA report consists of four steps:

Step 1 - Facility Information Collection

Step 2 - Facility Assessment

Step 3 - Reporting

Step 4 - Revisit and Review

The assessment program described in the following sections may be applied to:

- waste transportation companies;
- waste reclaimers;
- custom treating operations;
- incineration facilities;
- injection wells;
- landfarms; and
- landfills.

STEP 1 - INFORMATION COLLECTION

Initially, all waste services/facilities utilized or contemplated for use by a company for storage, collection, transportation, treatment or disposal must be identified. The identification of these services/facilities should be based on input received from company personnel responsible for selecting waste services/facilities to ensure no one is missed. This list should then be reviewed by those who contributed to its development and a priorization of services/facilities to be assessed undertaken. Ideally, every service/facility on the list should be assessed.

Once the services/facilities have been identified, the information collection process is initiated. The information to be collected may be organized into three categories:

- institutional;
- operational; and
- physical.

Institutional elements involve location, categorization and regulatory aspects of a facility or operation. Operational elements deal with the operations and processes of a facility that are usually subject to change by the persons operating and managing the facility. Physical elements include the physical features and behaviour of the facility relative to its surrounding environment, for example, meteorology, geology, hydrology, etc. Table 1 summarizes the information requirements for a waste service/facility assessment and the potential sources of information.

Permit applications and regulatory files are prime sources of data on institutional aspects. Copies should be made of all applicable information if permits and regulatory files are reviewed. Interviews with regulatory personnel (Federal, Provincial, Municipal, etc.) should be held to obtain their perspective on a service/facility over and above what is in the files. In addition, specific information about a service/facility may be obtained from facility inspections, site owner/operator interviews and formal written requests for specific information from the facility operators.

Operational information may be obtained from the owner, operator and regulatory personnel. Ideally, a facility visit should be undertaken and photographs taken (if allowed). The photographs may be used to record site conditions and for reference when writing a report. All photographs should be labelled, dated and retained within a facility file.

Physical aspects of a facility may be obtained from published and unpublished reports, site data, site visits and permit applications (for the considered facility or nearby facilities). Some information may not be site specific, but can provide base information for conditions near the facility. Occasionally, original data will have to be collected.

One of the best ways to collect all the institutional, operational and physical information concerning a facility, is to send a questionnaire to the owner and operator. The questionnaire acts as an information checklist and ensures all services/

TABLE 1

Information Requirements for Assessment of Waste Facilities

Category	Source	Information Requirement
INSTITUTIONAL	o Provincial Government Officials o Health Unit Inspectors o Facility Owner Interview o Facility Operator Interview o Facility Inspections o Permit Applications o Regulatory Files	o location of facility o type of facility o owner of facility o operator of facility o types of waste permitted o date facility opened o expected service life o closure plans o post closure plans o permits o regulatory history o insurance required/carried o manifest records o banking required/carried
OPERATIONAL	o Facility Owner Interview o Facility Operator Interview o Facility Inspections o Permit Review o Regulatory Officials	o site size, capacity and construction o site access o laboratory capabilities o monitoring program o physical facility capabilities o housekeeping procedures o transport of waste streams o spill response o safety
PHYSICAL	o Published and Unpublished Reports o Facility Data o Facility Inspections o Permit Applications	o meteorology o monitoring wells o soils information o hydrology o area geology

Note: These are the most common considerations for waste facility assessment.

facilities are asked for the same information. (The Canadian Petroleum Association questionnaire was comprehensive and was 41 pages in length.) The standardization of information collection may also help in subsequent steps of the assessment program when one service/facility may have to be compared to another. The initial questionnaire response should be followed up by personal interview to ensure that all pertinent information is provided, where applicable. If the questionnaire information collection process is not responded to, then the service/facility should not be utilized.

STEP 2 - FACILITY ASSESSMENT

Following the gathering of information and appraisal of the accuracy of the information, the collected data should be utilized to determine whether the service/facility should be used to store, collect, transport, treat or dispose of waste. Table 2 summarizes criteria that may be used for waste service/facility assessment. This list of criteria is not all inclusive and is intended only as a guide. Additional criteria should be added by the assessor of a service/facility based on local knowledge or requirements.

The service/facility after evaluation should be graded into one of three categories: "Acceptable", "Acceptable with Problems" or "Unacceptable". In many cases, the decision on whether to utilize a service/facility may be based on clear tangible evidence and there may be a considerable amount of data available upon which to base a decision. In other instances, the evaluators may need to use judgment when making a decision about a service/facility. To decide about a service/facility, the following three criteria should be used:

Table 2 Waste Service/Facility Assessment

Acceptable	Acceptable With Problems	Unacceptable
Institutional Aspects ☐ all permits in order ☐ location of facility complete ☐ type of facility complete ☐ facility permitted and technically able to handle waste received ☐ facility does not have a long history of violations; if any, are not very serious; violations corrected within specific time frame; operators cooperative with regulatory agencies ☐ closure plan complete with bond set aside (if applicable) ☐ insurance or other safety to cover environmental impairment or general liability to cover accidents and spills (if applicable) ☐ complete manifesting of incoming and outgoing wastes Operational Aspects ☐ all facility specifics complete and in order; land used for waste processing only or other compatible use. ☐ facility secure - no entry by unauthorized personnel and minimal exposure to wildlife and domestic animals ☐ laboratory - in house and/or outside laboratory with proper equipment and proper sampling techniques ☐ waste tests are run on samples prior to processing; samples are kept for future reference ☐ containment dikes are in good condition, have permitted amount of freeboard consistent with meteorology ☐ pits/ponds are lined to protect subsurface soils and minimize contamination of groundwater; disposal of pit/pond contents is performed in a suitable manner ☐ subsurface drainage is collected and treated or disposed of in a suitable manner ☐ bulk storage area has containment dikes; the materials are protected from the weather and ventilated (if appropriate); adequate aisle space and safety measures; provisions for spills ☐ tanks are within containment dikes; have warning or monitoring systems (if appropriate); disposal of tank contents is in a suitable manner ☐ pumps have gauges and automatic shut-offs or start-ups (if applicable) ☐ filters are in useful areas of the process; disposal of filter material is in a suitable manner ☐ housekeeping of the facility is good and the equipment is in good working order; rainwater is disposed of properly ☐ haulers of materials use all safety precautions ☐ precautions are taken for spill cleanups ☐ safety meetings involve all employees; proper safety equipment available; well experienced operators; quality training programs ☐ consultants are available to provide necessary information if in-house expertise is unavailable Physical Aspects ☐ physical and technical aspects of facility are suitable for environmental protection ☐ monitoring data indicated not contamination of groundwater; wells protected; sample frequency within permit requirements ☐ soils information indicates soil not susceptible to rapid leachate convection or appropriate liners are available ☐ hydrology of area shows that site will not affect any body of water ☐ geology of area indicates that the subsurface features are stable and there are no risks of seismic activity ☐ no existing indications of surface or subsurface water contamination or very low probability that any contamination of surface or groundwater will occur	☐ small holding capacity ☐ inadequate recordkeeping system ☐ better management control required ☐ problems with mud disposal ☐ no soil borings but other data or information available ☐ little to no soils data ☐ little to no groundwater data ☐ regulatory history indicates some problems ☐ reoccurring minor regulatory problems and violations ☐ disposal method involves injecting improper solid wastes ☐ poor housekeeping ☐ containment dikes not adequate ☐ drill mud spill control needs improvement ☐ improper disposal of small amounts of filtered material ☐ saltwater precipitates outside containment areas ☐ minimal site security during operating hours ☐ inconsistent testing of wastes (non-hazardous) ☐ inefficient dewatering method for drill mud ☐ use of unlined earthen pits ☐ discharge of non-contact rainwater from disposal area to nearby creek ☐ facility generates wastes or by-product during process which is transported to another facility - the other facility not reviewed ☐ waste (small amount) sent to unacceptable disposer ☐ meets regulations - site not lockable (remote area) ☐ oily material in unlined earthen pit ☐ operate open burn pit ☐ near schools or other facilities ☐ tank bottoms mixed with another oil company's waste - no control over waste mixture ☐ fluid levels not monitored to prevent liquid escape and overflow ☐ liner material of earthen pit subject to leaks ☐ placement of oily material on ground for road base (even if allowed) ☐ no monitoring wells or insufficient number of monitoring wells around site ☐ animals occasionally graze on disposal area (non-hazardous) ☐ improper storage of material ☐ inadequate manifesting of materials (non-hazardous) ☐ facility near contaminated aquifer though facility is not source of contamination ☐ evaporate dewatering of drill mud in areas where evaporation is an inappropriate disposal method due to high rainfall rates and low evaporation rates ☐ odour problems ☐ waste migrating from holding pond/pits into subsurface soils (usable aquifers protected) ☐ public opposition	☐ Federal, Provincial or local regulatory agency operating permits not secured ☐ accepting waste other than that designated on permit ☐ long history of regulatory violations (perhaps with large fines); no attempt to remedy the problems, etc. ☐ facility does not limit access to unauthorized personnel ☐ no containment dikes around tankage ☐ unlined pits/ponds in highly permeable soils thus endangering aquifers of surface waters ☐ growing food crops or raising domestic animals on land for waste disposal ☐ discharge of rainwater runoff in violation of permit ☐ violation of operating permit(s) ☐ monitoring wells indicate contaminants escaping from process/ disposal area ☐ soils are high permeability and facility exhibits high probability of groundwater contamination ☐ seismic data indicates risk of contamination from seismic activity ☐ hazardous waste leachate moving from facility into underlying groundwater sources ☐ lack of waste liquid containment and proper discharge as per permits ☐ numerous violations of permit conditions (with or without regulatory enforcement) ☐ bad housekeeping indicating a lack of environmental concern Note: usually there are other problems accompanying poor house keeping (i.e. poor maintenance of equipment, etc.) ☐ routine flood hazard - facility not protected from at least 25 year flood return frequency or level in regulations, which is greater ☐ special circumstances (e.g. severe damage to fish hatchery or wildlife sanctuary area; severe potential to create a hazard for endangered species, severe impact to a sensitive element of the environment, etc.) ☐ evidence that the facility is not financially stable

- knowledge of the environment and the forces affecting the environment;

- consideration of how the waste service/facility affects the environment; and

- knowledge of how environmental forces affect the waste service/facility method.

In essence, the environment, the environment's effects on the facility and the facility's effects on the environment will be the biggest unknowns about each facility. The stability and permeability of the soils, the locations of surface and subsurface waters, and the climatology of the area, etc. are all important aspects affecting a facility's effectiveness. Yet, very little, if any information may be available on any of these aspects. In such cases, the evaluator should use whatever environmental information is available plus the evaluator's knowledge about a facility, its operations, and the type of waste processed at the facility to make a judgment decision on the facility. If there is no information on a very important aspect, this, of itself, may be grounds for an assessment of "Unacceptable".

Services or facilities that are deemed "Acceptable" or "Unacceptable" may be easier to determine than less definite cases. Acceptable services/facilities will have all pertinent management and environmental information and will operate in an environmentally and technically sound manner. Unacceptable services/facilities will have one or more significant problems with their operational and/or environmental aspects which greatly increase the potential of adverse regulatory or environmental consequences, or they will have minor problems which may indicate inept management practices that could lead to more serious problems at a later time. The lack of pertinent information may render a service/facility unacceptable for use.

Services/facilities that are deemed "Acceptable with Problems" may exhibit a variety of minor environmental and operational inadequacies. The nature of the inadequacies may not be sufficient to render a facility unacceptable, but the inadequacies should not be overlooked and should be noted to warn of possible problems. The nature and degree of the inadequacies may require a judgment determination as to whether the service/ facility should be used to store, collect, transport, treat or dispose of waste.

STEP 3 - REPORTING

All of the information accumulated about a service/ facility should be kept in a secure filing system for future reference. The files should be in an easily accessible location such as at corporate headquarters. Site specific information should be kept in individual files under the service/facility name. General information such as maps, site reports (for a general area), water data, etc. may be filed apart from site specific data but should be available.

A summary report that highlights the most important aspects of a facility should be developed. It should be one page, contain basic information, yet describe the facility. An example of a summary sheet is presented in Figure 1. Each time a facility is visited, a new summary report should be written with any new or changed information included.

Some facilities may require more specific information than that included in the summary report. In such a case, a site specific report could be generated. Detailed information could be included in the site specific report. The site specific

FIGURE 1
WASTE SERVICE/FACILITY PROFILE

No: 001
Date: Jun 15,1990
Revision: Jul 17,1990

Canadian Petroleum Association

FACILITY NAME:

FACILITY ADDRESS:

CONTACT PERSON:

PHONE NUMBER:

OPERATING HOURS:

FACILITY TYPE:

LOCATIONS:

PERMITS/APPROVALS:

WASTE HANDLED:

GENERAL DESCRIPTION:

EQUIPMENT:

SERVICES PROVIDED:

REGULATORY HISTORY:

INSTITUTIONAL ASSESSMENT:

OPERATIONAL ASSESSMENT:

PHYSICAL ASSESSMENT:

R22WSProfile

FIGURE 2
SITE SPECIFIC REPORT FORMAT

Date: July 20, 1990
Revision: July 20,1990

FACILITY NAME:

LOCATION:

GENERAL OVERVIEW:

INSTITUTIONAL ASPECTS

PERMITS/REGULATORY APPROVALS

TYPE OF FACILITY

TYPE OF WASTES HANDLED

REGULATORY HISTORY

CLOSURE PLAN

POST CLOSURE PLAN

INSURANCE AND BONDS

FINANCIAL DATA

1 OF 4

OPERATIONAL ASPECTS

SITE SPECIFICS

SITE ACCESS

LABORATORY FACILITIES

WASTE TESTS PERFORMED

MANIFEST PROCEDURE

CONTAINMENT DYKES

PITS/PONDS

SUBSURFACE DRAINAGE SYSTEM

BULK STORAGE AREA

TANK UTILIZATION

PUMP UTILIZATION

FILTER UTILIZATION

HOUSEKEEPING OF FACILITY

RUNOFF MANAGEMENT

TRANSPORTATION OF MATERIAL TO A FACILITY

SPILL RESPONSE AND CLEANUP

SAFETY PROGRAMS/PROCEDURES

RESOURCES UTILIZED FOR ADVISORY PURPOSES

PHYSICAL ASPECTS

AREA METEOROLOGY

SOILS INFORMATION

AREA HYDROLOGY

AREA GEOLOGY

AIR QUALITY

MONITORING WELLS , PIEZOMETERS AND/OR LYSIMETER

EVIDENCE OF WASTE MIGRATING FROM FACILITY

ASSESSMENT

INFORMATION SOURCES:

report may be quite lengthy depending on the amount and type of information requested and available on the service/facility. An example of a site specific report format is presented in Figure 2.

STEP 4 - REVISIT AND REVIEW

If a service/facility is to be used, then periodic reevaluations must be made to ensure the continued proper handling and treatment of waste. The revisit and review will be to note if the site has been physically altered, closed, moved or otherwise modified such that its acceptability or unacceptability may be altered. Frequency of revisits depends on the amount and type of waste that has been processed at the facility, and the proximity of the operation to the waste generating facility, as well as, the desirability for use. Some facilities may be reviewed periodically, solely to maintain a list of readily available backup facilities.

As new information becomes available about a service/facility, or its surrounding environment, this information should be incorporated into the files.

WASTE MANAGEMENT SYSTEM ASSESSMENT PROGRAM IMPLEMENTATION

The primary reason to implement a waste management system assessment program is to minimize liability. To achieve this, assessment information must be made available to those responsible for waste management within a company.

The dissemination of information generated by the waste management system assessment program may best be achieved through the use of a summary recommendation book. This book would contain a confidential, organized accumulation of the summary reports of all waste services/facilities evaluated by a company. This book should be kept in the corporate office and made available to personnel selecting waste services/facilities on an as required basis.

Responsibility and accountability to coordinate the use of third party waste services/facilities must be assigned to specific person(s) within a company. This ensures that information is continually updated and provides a contact name(s) to those services/facilities wishing to update information. This person(s) will maintain the summary report book and prepare and disseminate service facility lists to company personnel. The assessment program information could be used by company officials to develop an internal "certified for use" list. A waste service/facility would not be utilized unless it has been "certified".

The evaluation of third party waste services/facilities should be coordinated by the person(s) assigned the responsibility for the program and performed by in-house environmental staff or outside consultants. Initial and routine follow-up investigations should be performed depending on need. The frequency of follow up investigations of a service/facility should be based on:

- frequency of use;
- need of backup facilities; and
- condition and type of facility.

ISSUES OF PROGRAM IMPLEMENTATION

The implementation of an assessment program (and ultimately a certified for use designation) for waste transporters, treatment/disposal contractors and disposal sites by a company, raises four important issues. The first issue is that knowledge that a particular service/facility has satisfied the assessment requirements for use, could adversely impact price negotiations.

A second issue is that severe legal liabilities could result from public knowledge that a service or facility has failed a company review. It is imperative that the waste management assessment program results and all documents developed pursuant to the system be kept confidential. A strict reporting structure should be developed to ensure confidentiality.

A third issue is that once an assessment or certification system is initiated, it must be maintained on an ongoing basis to:

- ensure that facilities continue operations at an acceptable level; and
- allow for other facilities to become "certified" as the need arises.

The final issue is that once a service/facility has been identified as unacceptable for use, they should not be utilized if possible, until measures are taken to correct the deficiencies. To continue to use a service/facility which is known to have problems when suitable alternatives are available, may have liability implications.

CASE STUDY

The waste management assessment program described was applied to over 80 waste services/facilities in western Canada by the Canadian Petroleum Association. The following general conclusions were made as a result of this analysis:

- some generators were not assuring themselves that the facilities they utilize can accept, properly handle, or have the capacity to manage waste sent offsite;
- some waste transportation contractors, treatment/ disposal contractors and disposal sites either ignore or do not understand regulatory requirements; and
- regulatory requirements were not being enforced.

Specific observations included:

- services and facilities were operating without proper permits;
- transportation vehicles were not placarded;
- vacuum trucks were seen to be leaking;
- waste was being sent to facilities that could not store, handle or treat it properly;
- waste was being accepted by contractors/facilities even though they were not technically able to handle it or they had insufficient capacity;
- waste was being disposed of that had not been put through a treatment system;
- drums accepted from companies for disposal were stored in areas that were not bermed and in some cases were noted leaking onto the soil;
- many sites had environmental problems resulting from previous owner's operations which were not properly

addressed prior to purchase and remedial work may have a significant cost impact;

- many of the waste treatment facilities with bulk tanks were not properly bermed to contain an accidental release;
- berm drains were not properly plugged;
- spills at some sites were not cleaned up or they were just covered with clean fill;
- at one site waste was stored in rig tanks placed in the groundwater and the waste material appeared to have contaminated the groundwater either by leaking from the tanks or through spillage during off loading operations;
- meters used on some sites were found not to be working properly or they had not been calibrated within the past year;
- waste going downhole into a deepwell in many cases was not in accordance with permit conditions i.e. waste not permitted was going downhole or waste generated from other formations was being disposed in contradiction of permit conditions;
- personnel at some facilities were not properly trained;
- soils at some sites exhibited high permeability and the facility exhibited a high potential to contaminate the groundwater through daily operations;
- contaminated surface runoff was not being collected at some sites;

- security in most cases was poor at waste treatment and disposal sites and unauthorized personnel had ready access; and
- some facilities exhibited poor housekeeping indicating a lack of environmental concern.

The scope and magnitude of the problems identified, appear to justify the need for a waste management assessment program. An internal assessment program by a company for waste services or facilities will not eliminate the problems noted above. This type of program will however minimize liabilities associated with improper waste management because only those waste services/facilities will be utilized that meet a company's specified standard.

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The Emerging Role of Trade Associations as Interest Groups

Robert Redhead, Canadian Environment Industry Association
Toronto, Ontario

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RECYCLING ISSUES INVOLVING USED OIL

by

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ABSTRACT

Currently, there is an over-supply of used oil in Alberta. Up to 50 million litres of used lubricating oils are produced annually in Alberta. Although approximately 40 percent of this annual total will be re-refined and approximately 20 percent re-processed in 1990 by a few major oil recycling companies, it has been estimated that at least 40 percent of Alberta's used lubricating oil is disposed of in an unregulated manner, including discharge to landfills, sewer systems, and surface waters.

These uncontrolled discharges are a threat to human health and the environment due to the heavy metals, phenols, and other organic and inorganic contaminants they contain. Therefore, increasing the amount of used oil being recycled in Alberta and other provinces is an important element in the protection of Canada's environment.

Today, the re-refining industry is only marginally profitable due to the small difference between the re-refined base oil production cost and the sale price of the finished product. A study recently commissioned by Alberta Environment on the economics of re-refining used lubricating oil in Alberta has identified a lack of markets as the major constraint to increasing the amount of used oil being re-refined in the Province.

The management of used oil in Canada is at a critical stage and industry and government face some major decisions over the next year. In August 1989, the Canadian Council of Ministers of the Environment (CCME) published the Code of Practice for Used Oil Management in Canada, which describes environmentally sound options

for the handling, storage, collection, transportation, recycling, and disposal of used oils in Canada. The Canadian Petroleum Products Institute (CPPI) recently acknowledged that the petroleum industry must play a strong role in ensuring that used oil is managed in an environmentally acceptable manner, through the release of the CPPI Used Oil Action Plan. The Plan makes recommendations on a used oil return and collection system across Canada as well as regional disposition options.

Alberta Environment is taking a number of initiatives to enhance recycling of this valuable non-renewable resource. A procurement policy is being drafted which will give preference to the use of re-refined oil in government vehicles. A "buy recycled products" education campaign is planned as part of Alberta's proposed Comprehensive Waste Minimization/Recycling Program. Alberta Environment will also work with the Canadian Petroleum Products Institute to establish a used oil return and collection system across Alberta and establish regional disposition options.

INTRODUCTION

Adopting strategies that follow the hierarchy of waste management (4Rs: Reduce, Reuse, Recycle, and Recover) is essential to solving Canada's used oil problem and minimizing the "not in my back yard" (NIMBY) problem. Waste reduction efforts must come first, then the maximization of recycling before turning to incineration and disposal for the remaining fraction. This hierarchy offers the best opportunity to direct waste management away from the treatment of pollution towards the prevention of pollution. Recycling programs increase awareness of the first 3Rs and help establish the essential principle that we are all responsible for the management of our wastes. The NIMBY problem will not be solved if disposal continues to be the primary method of managing our waste.

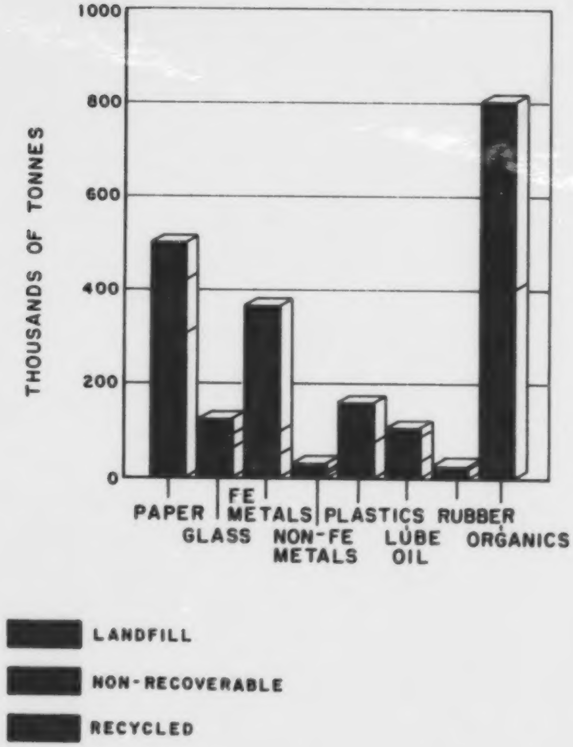
Alberta's Recycling Industry

The recycling industry is growing substantially and becoming a significant component of Alberta's economy. The industry is currently comprised of over 650 firms employing approximately 5,000 people. Comparison to other sectors of the economy shows that recycling activity is significant. In terms of value of products produced, the recycling industry is (Stanley, 1988):

- over six times larger than Alberta's primary forest products industry;
- 14 percent as large as the construction industry;
- 20 percent as large as agriculture; and
- 60 percent as large as the mining sector.

A total of 2.3 million tonnes of waste materials are generated in Alberta annually. Of this volume, approximately 19 percent (439 thousand tonnes) is currently being recycled. However, a significant portion of the waste stream is non-recoverable due to consumption or contamination (Figure 1). When non-recoverable materials are excluded, the total volume available for recycling is about half, or 1.2 million tonnes annually.

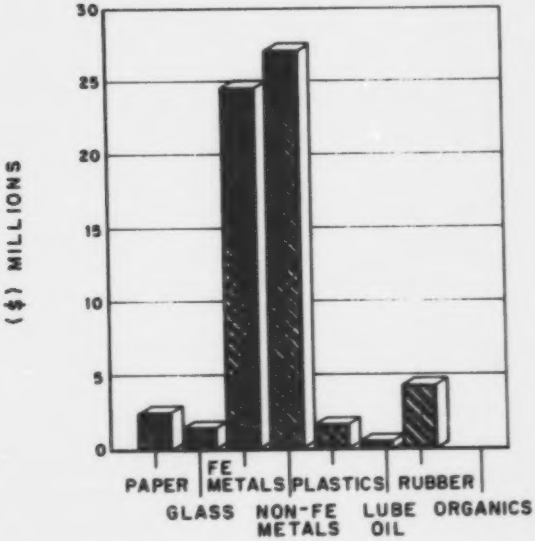
Used oil represents approximately five percent of the total waste stream, of which approximately 50 percent is non-recoverable. The proportion of used oil in the total waste stream is low compared to organics (37 percent) and paper (23 percent). The total value of materials recycled in the Province is estimated at $61.5 million (Figure 2). As is evident from Figure 2, used oil is in the lowest value category, which is one of the barriers to its recovery. However, Alberta's re-refining industry is growing and it is estimated that the two Alberta re-refiners, Hub Oil Company Ltd. in Calgary and Turbo Lubricants Recycle Oil Services in Edmonton, will re-refine approximately 21 million litres of used oil in 1990. This is an increase from a throughput of only 12 million litres in 1988.



WASTE QUANTITIES IN ALBERTA 1987

NOTE: AFTER STANLEY ASSOCIATES ENGINEERING LTD. 1988

FIGURE 1



VALUE OF RECYCLED MATERIALS IN ALBERTA
1987

NOTE: AFTER STANLEY ASSOCIATES ENGINEERING LTD. 1988

FIGURE 2

Used Oil Definition

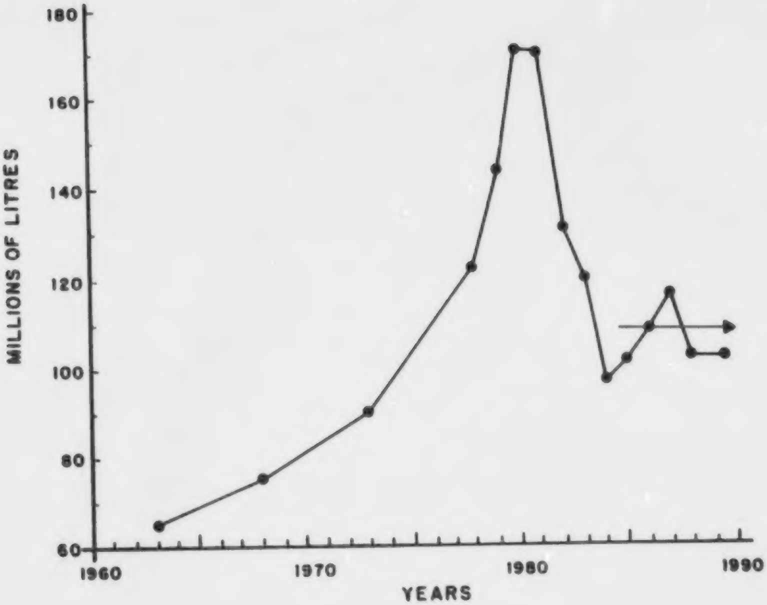
The Canadian Council of Ministers of the Environment (CCME) published the "Code of Practice for Used Oil Management in Canada" in August 1989. The Code of Practice defines used oil as an oil from industrial and non-industrial sources which has been acquired for lubricating or other purposes and has become unsuitable for its original purpose due to the presence of impurities or the loss of original properties. Used oil does not include oil derived from animal or vegetable fats, nor does it include crude or fuel oils spilled onto land or water and wastes from petroleum refining operations. The following categories of used oil are covered by the Code of Practice (1989):

- lubricating oils (engine, turbine or gear);
- hydraulic fluids (including transmission fluids);
- metal working fluids; and
- insulating fluids or coolant.

Used Oil Inventory

The quantities of used lubricating oil in the Province are related to economic activity. As shown in Figure 3, the sales of lubricating oil have increased steadily from 1960 to the present, except for the down-turn in the economy in the early 1980s. Sales of lubricating oil have averaged approximately 110 million litres/annum over the last four years.

Not all lubricating oil sold is recoverable. It is generally accepted that 50 to 60 percent of the oil is consumed during use. In a report commissioned by Alberta Environment on the economics of re-refining used lubricating oil in Alberta, Monenco (1989) estimates that 48.4 million litres of used oil are potentially recoverable for recycling in Alberta. This figure assumes current



LUBRICATION OIL SALES IN ALBERTA 1960-1990

NOTE: AFTER STATISTICS CANADA

FIGURE 3

total sales at 110 million litres/annum. Based on discussions with the two Alberta re-refiners, it is estimated that in 1990 about 21 million litres of used oil will be collected and re-refined. This represents approximately 75 percent of their available plant capacity on a feedstock throughput basis.

Historically, in Alberta re-refining represents between 15 and 20 percent of recoverable used oil. However, in 1990 the demand for re-refined oil has increased and the market for the recoverable portion of used oil is estimated as: 40 percent re-refined, 20 percent fuel and road oiling, and 40 percent unaccounted for (Figure 4). It appears that much of the unaccounted for used oil is generated by "do-it-yourself" (DIY) oil changers, and that much of it is disposed in landfills, in urban areas and down municipal sewer systems.

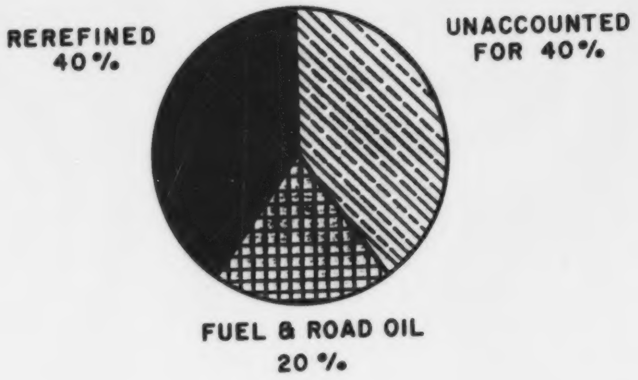
EXISTING REGULATIONS

Federal and Alberta regulations, standards and guidelines relating to the management of used oils are summarized in Table 1.

Federal Regulations

There are no federal regulations in Canada which deal specifically with the management of used oils. The Transportation of Dangerous Goods (TDG) Act and regulations may apply to the transportation of used oils.

Alberta has adopted the federal regulations for provincial transport of used oil. The TDG regulations require the documentation, proper handling and transportation of dangerous goods. The TDG regulations cover the transportation of used oils which are contaminated with hazardous substances or are otherwise dangerous.



RECOVERABLE PORTION: 48.4×10^6 L/annum (1990)

ESTIMATED MARKET OF USED OIL IN ALBERTA 1990

NOTE: AFTER MONENCO CONSULTANTS LTD. 1988 (UPDATED)

FIGURE 4

TABLE 1: SUMMARY OF FEDERAL AND ALBERTA REGULATIONS RELATING TO USED OIL

JURISDICTION	REGULATORY DOCUMENT	DESCRIPTION
Alberta	Hazardous Chemicals Act Hazardous Waste Regulation	- No specific used oil legislation - Waste lubricating oil intended for reuse, reprocessing, or recycling is exempt from the Act and regulation.
	Department of Labour Act Regulation 127/71	- Requires the installation of oil and grease interceptors on waste outlets or all public garages.
Canada	Environmental Contaminants Act, Chlorobiphenyl Regulation No. 3	- Sets 5 ppm as the maximum permissible concentration of PCBs in used oil applied to roads for dust suppression purposes. - Sets a limit of 50 ppm for any release to the environment and for classifying oils as hazardous with respect to handling, storage, transport, and disposal.
	Transportation of Dangerous Goods Act and Regulations	- Regulates the offering for transport, handling, and transportation of dangerous goods for interprovincial and international shipment by all modes; responsibility for transportation within provincial borders is under provincial jurisdiction.
	Fisheries Act	- Deposits of deleterious substances into sea and inland waters are prohibited (used oil is a deleterious substance).
	Migratory Birds Convention Act and Regulations	- Deposit of oil in or near waters and on ice frequented by birds is prohibited.
	Ocean Dumping Control Act	- Crude oil and its wastes, petroleum products/residues and any mixture of these are prohibited substances for which a dumping permit cannot be granted.

A hazardous substance is defined by the TDG regulations as a product or substance that is included in Division 2 of Class 9 in List II of Schedule IV. Hazardous substances in this class are exempt if they contain less than 0.01 weight percent, or 100 ppm of each substance listed (CCME, 1989). Used oil could be considered hazardous if it contains in excess of 100 ppm of the following substances:

- lead;
- zinc;
- trichloroethane;
- trichloroethylene;
- benzene;
- toluene;
- xylene; and
- PCBs (greater than 50 ppm content).

The TDG regulations classify liquids or mixtures of liquids as dangerous and flammable under Class 3 if they have a flash point below 61°C. Consequently, used oil may be dangerous as it could have a flash point below 61°C and a lead level exceeding 100 ppm.

Chlorobiphenyl regulations under the Environment Contaminants Act sets five ppm as the maximum permissible concentration of PCBs in used oil applied to roads for dust suppression purposes. A limit of 50 ppm is also set for any release to the environment and for classifying oils as hazardous with respect to handling, storage, transport and disposal.

Alberta Regulations

Alberta has no legislation specific to used oil. Under the Hazardous Chemicals Act, Hazardous Waste Regulation 505/87, used lubricating oil intended for reuse, reprocessing or recycling is currently exempt from the Act and Regulation. In this case there is no requirement to manifest shipments of used oil.

Alberta has adopted the Transportation of Dangerous Goods Act and regulations to control the documentation, proper handling and transportation of used lubricating oil in the Province.

Interim Guidelines for Road Oiling

Although Alberta has no legislation specific to used oil, Alberta Environment did establish interim guidelines in the spring of 1989 concerning the application of used oil to road surfaces for dust suppression purposes (Figure 5).

Three key parameters from the Transportation of Dangerous Goods Act have been selected to control the quality of used oil being applied to Alberta roads: a minimum flash point of 61°C, a maximum PCB concentration of five ppm and a maximum lead level of 500 ppm. The lead level is the only constituent which exceeds the recommended limits established by the TDG Act (100 ppm). The higher lead concentration was necessary for practical purposes since the analyses of 835 samples of used oil (Franklin Associates Ltd., 1985) resulted in an average lead concentration of 665 ppm and a median lead concentration of 240 ppm (see Table 2). Taking into account the results of these analyses and British Columbia's road oiling standards (maximum lead level of 1,000 ppm), a maximum level of 500 ppm was established. This recommended limit will be reduced in 1991, since lead levels in used automobile oil will be greatly reduced when leaded gasoline is phased out in December, 1990.

Alberta Environment has a preference for recycling used oil, which is a higher order of use, and does not encourage the use of used oils for road oiling. However, due to the current over-supply problem throughout the Province, Alberta Environment prefers that the used oil be handled in a controlled program as opposed to indiscriminate dumping. If it is found at any time that road oiling represents an unacceptable environmental impact or threatens human health, the practice will be discontinued immediately.

FIGURE 5

ALBERTA ENVIRONMENT INTERIM GUIDELINES APPLICATION OF USED LUBRICATION OILS TO ROAD SURFACES FOR THE PURPOSE OF DUST CONTROL

Alberta Environment will not object to the practice of road oiling for dust suppression, subject to the following voluntary restrictions:

1. No person shall, without approval, apply waste oil to any land for the purpose of road dust control unless:

   a) The waste oil has the following properties:

Total lead	500 ppm maximum
PCB	5 ppm maximum
Flash Point	61°C minimum

   b) The location of the proposed application will be more than 25 m from surface water or a domestic well.

   c) The application rate will not result in a visible runoff of oil beyond the travelled portion of the road or other land.

   d) Permission has been given by the owner of the land to which the oil is applied.

2. Persons engaged in the practice of road oiling should develop contingency plans, including the identification of appropriate equipment and personnel, to deal with any oil spills.

It should be noted that the recommended action is a statement of intent by Alberta Environment and not a blanket, conditional approval. Restrictions may apply from other agencies, including Alberta Transportation and Utilities and individual municipal governments; these other restrictions will be maintained.

If voluntary compliance is effective and the suggested guidelines are sufficient to address environmental and health concerns, Alberta Environment would prefer not to interfere with the practice of road oiling in the near future. We hope that recycling initiatives will create a much higher demand for this valuable non-renewable resource in the future.

USED OIL CHARACTERISTICS

Used oil consists mainly of hydrocarbons. However, it may contain additives such as detergents and viscosity improvers used in lube oils for gasoline engines. The amount and type of additives vary with the intended use of the oil. Hydraulic oils, for example, contain very few additives, whereas lubricating oils contain 10 percent to 20 percent by volume. The additives, as well as their degradation products, contribute metallic impurities (e.g. zinc, magnesium and calcium), organic and inorganic salts and chlorinated organics to the used oil (CCME, 1989). In addition, the oil may be contaminated during use by metals from wear, as well as lead, soot and water from fuel combustion products.

Table 2 summarizes the concentration of potentially hazardous constituents in used oils. Used oil can contain hazardous substances as defined in the TDG regulations. The median concentration levels listed in Table 2 exceed the recommended limits for lead, zinc, trichloroethylene, toluene and xylene. It is assumed that the analyses represent the Alberta situation.

TABLE 2: Concentration of Potentially Hazardous Constituents in Used Oils[a,b]

Parameter	Number of Samples Analyzed	Samples with detected contaminants number	Samples with detected contaminants percent	Mean concentration[c] (ppm)	Median concentration[c] (ppm)	Concentration at 75th percentile[d] (ppm)	Concentration at 90th percentile[d] (ppm)
Metals							
Arsenic	537	135	25	17	5	5	18
Barium	752	675	89	132	48	120	251
Cadmium	744	271	36	3.1	3	8	10
Chromium	756	592	78	28	6.5	12	35
Lead	835	760	91	665	240	740	1,200
Zinc	810	799	98	580	480	872	1,130
Chlorinated Solvents							
Dichlorodifluoromethane	87	51	58	373	20	160	640
Trichlorotrifluoroethane	28	17	60	62,900	160	1,300	100,000
1,1,1-Trichloroethane	616	388	62	2,800	200	1,300	3,500
Trichloroethylene	608	259	42	1,390	100	200	800
Tetrachloroethylene	599	352	58	1,420	106	600	1,600
Total Chlorine	590	568	96	5,000	1,600	4,000	9,500
Other Organics							
Benzene	236	118	50	961	20	110	300
Toluene	242	198	81	2,200	380	1,400	4,500
Xylenes	235	194	82	3,390	550	1,400	3,280
Benzo(a)anthracene	27	20	74	71	12	30	40
Benzo(a)pyrene	65	38	58	25	10	12	16
Napthalene	25	25	100	475	330	560	800
PCBs	753	142	19	109	5	15	50

[a] from Franklin Associates Ltd. (1985)
[b] results determined from the analyses of 1,071 used oil samples
[c] calculated for detected concentrations only
[d] for the purpose of determining median and percentile concentrations, undetected levels were assumed to be equal to the detection limit.

Note: After Franklin and Associates, 1985.

Engine oils (lubricating oils) are also typically more contaminated than metalworking fluids which are, in turn, somewhat more contaminated than hydraulic fluids (Franklin Associates Ltd., 1985).

USED OIL DISTRIBUTION AND COLLECTION

Used oil distribution and the ability to collect it economically has a significant impact on the total quantities that can be re-refined. Used oil distribution is directly related to sales distribution. Therefore, the greatest concentration of used oil is to be expected in urban areas and the greatest recovery and re-refining would occur in the Edmonton and Calgary areas (Table 3).

Farm sales represent a large source of used oil in the Province. Farmers represent less than three percent of Alberta's population, yet consume approximately 20 percent of the total annual sales of lubricating oils. The Province-wide distribution of farmers presents higher-than-average collection costs. A study conducted by Synergy West Limited (1974) concluded that 40 percent of the lubricating oil sales in the province were in Edmonton, Calgary, Lethbridge, Grande Prairie, Red Deer, and Medicine Hat.

Private companies collect used oil in the Province. Within the last two years, the costs to the re-refiner of obtaining used oil have varied considerably. In 1981, used oil from some provincial sources was purchased for as much as $0.18/L, while collection charges in the last two years have ranged from $0.02/L in urban areas to $0.20/L in remote rural areas.

Resource Recovery Grant Program

In 1977, Alberta Environment initiated funding to provide collection tanks for used oil within the Province. Through the

TABLE 3: ESTIMATED LUBRICATING OIL SALES IN ALBERTA BY DISPOSITION SECTOR AND DISTRIBUTION

DISPOSITION BY SECTOR	QUOTED RANGE (% OF SALES)	DISTRIBUTION (HIGHEST REGION)
RETAIL GASOLINE OUTLETS	13 - 24	URBAN
FARMS AND AGRICULTURE	18 - 21	RURAL
GOVERNMENTS (FEDERAL & PROVINCIAL)	<1 - 1	URBAN
CONSTRUCTION INDUSTRY	4 - 8	RURAL
FOREST PRODUCTS INDUSTRY	1 - 2	RURAL
MINING AND PETROLEUM INDUSTRY	6 - 22	RURAL
RAILWAYS	7 - 8	URBAN
OTHER (TRANSPORTATION, UTILITIES, ETC.)	30 - 31	VARIED

Note: After Monenco Consultants Ltd. 1988.

Department's Resource Recovery Grant Program, local municipalities or non-profit groups could apply for grants to cover costs related to the purchase and installation of used oil storage tanks. To date, 64 tanks have been installed. The purpose of the program is to encourage the collection and recycling of used oil.

Oil Drop Program

The Oil Drop Program was established in 1981 to provide a safe and easy way for do-it-yourselfers to dispose of their used oil. Service stations could participate by putting their names on the oil drop list and by displaying an oil drop location sign. Initially, when used oil had a value of up to $0.18/L, approximately 300 service stations throughout the province actively participated in the program. However, due to the current economics of the re-refining industry, a collection fee has been charged for approximately two years and many of the service stations are no longer accepting used oil.

RECYCLING AND REUSE OF USED OIL

Used oil can be recycled or reused in a variety of ways. The most desirable alternatives conserve the lubricating properties of the oil, utilize its heating value and help reduce the consumption of virgin oils. The CCME's recommended recycling practices in order of preference are:

- re-refining and reprocessing;
- burning in cement kilns;
- burning in industrial and utility boilers equipped with flue gas pollution control equipment; and
- burning in boilers not equipped with flue gas pollution control equipment when used oil fuels meet specified standards for maximum contaminant levels and minimum heating values.

Road oiling or uncontrolled burning are not recommended practices unless it can be demonstrated that under particular circumstances (for e.g., rural areas and northern regions) they are the best available control technology (defined as the technology providing the most benefit to the area at the least expense to the environment).

Re-Refining

Re-refining technologies are designed to fully restore the original usefulness of the oil. The technological capabilities of the re-refining industry have advanced to the point where most used oils can be successfully recycled (CCME, 1989). The commercially proven re-refining processes commonly used in North America are:

- acid/clay treatment;
- vacuum distillation/clay polishing;
- vacuum distillation/hydrotreating; and
- chemical demetallization/distillation/hydrotreating.

The acid/clay process and the vacuum distillation/hydrotreating process, or some modifications thereof, are used in Canada (Table 4). The acid/clay process is used exclusively by two Alberta re-refiners: 1) Turbo Lubricants, Recycle Oil Services in Edmonton and 2) Hub Oil Company Limited in Calgary. Alberta's overall 1990 throughput feeds will be higher than in 1986; however, the table puts into perspective the used oil recycling capacity throughout Canada.

The acid/clay process is the oldest and most common re-refining technology. Used oil is treated with sulphuric acid, which dissolves and settles metal salts, particles, aromatics, organic acids, polar compounds and dirt. These contaminants form a sludge which settles from the oil and is drawn off and treated for

TABLE 4: DESCRIPTION OF RE-REFINERS IN CANADA

RE-REFINER	PROVINCE	CITY	PLANT CAPACITY (10^6L/YR)	THROUGHPUT FEED-1986 (10^6L/YR)	TYPE OF PROCESS
MOHAWK	B.C.	N.VANCOUVER	34	20	VACUUM DISTILLATION/ HYDROTREATING
TURBO	ALBERTA	EDMONTON	13 *13	10 * 9	ACID/CLAY
HUB OIL	ALBERTA	CALGARY	9 *15	4.5 *12	ACID/CLAY
MAGNUM	SASK.	SASKATOON	1	0.5	ACID/CLAY
BRESLUBE	ONTARIO	KITCHENER	114	82	VACUUM DISTILLATION/ CLAY OR HYDROTREATING
OIL CANADA	ONTARIO	TORONTO	49	32	PHILLIPS/ SHELL HYDROTREATING
CORUNDOL OIL	ONTARIO	REXDALE	4.5	N/A	VACUUM DISTILLATION/ CLAY
TOTAL	-	-	224.5	149	-

Note: After Fisher, 1986
* Updated 1990

disposal. Clay addition followed by filtration is used to remove any remaining color bodies. Turbo Lubricants currently neutralizes the acid sludge (ph 7 or 8) by mixing it with calcium-magnesium carbonate from the City of Edmonton's water softening facilities to produce a semi-solid sludge. The sludge is then disposed of at the City's Clover Bar Landfill. Hub Oil also neutralizes their acid sludge prior to landfilling.

The vacuum distillation/hydrotreating process involves vacuum distillation followed by the addition of hydrogen which converts hydrocarbon residues into marketable products. This process has the advantage of eliminating the disposal of the acid/clay sludge associated with the acid/clay process. Hydrotreating also improves and stabilizes the colour of the oils.

Oil yield and quality differ for various technologies. For example, vacuum distillation processes typically yield about 10 percent more oil than acid/clay processes (CCME, 1989). In addition, the basestocks produced from the vacuum distillation processes are reported to be of better quality because the acid/clay technologies are less capable of completely removing certain contaminants from used oil (Surprenant et al., 1983). However, the acid/clay process has lower capital equipment costs and low technology operation costs compared to vacuum distillation.

The material balance for Alberta acid/clay facilities can be summarized as follows (Monenco, 1989):

- base oil, 70 percent;
- fuel gas, 20 percent; and
- waste products, 10 percent.

Alberta-derived base oil is characterized as a typical paraffinic base oil, which is described as a ASTM 250 neutral; this closely resembles a motor oil such as SAE 20 W. This base oil is then blended with purchased virgin base oils to obtain products with the characteristics desired.

In Alberta the relative percentages of products produced from re-refined oils is thought to be (Monenco, 1989):

- crank-case oils, 36 percent;
- hydraulic oils, 13 percent;
- gear oils, 6 percent;
- chain oils, 7 percent;
- journal oils, 27 percent; and
- other (mineral oils), 11 percent.

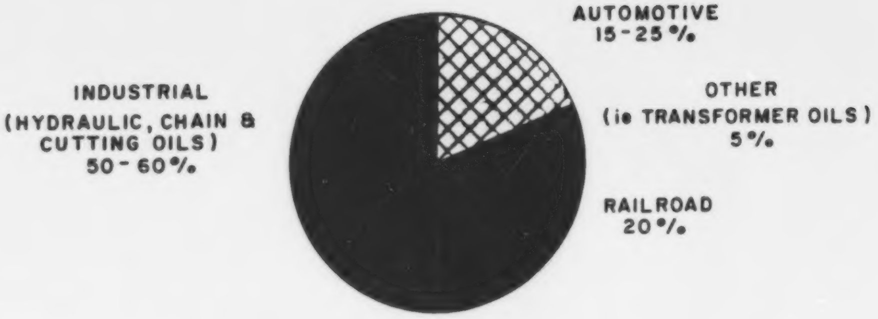
RE-REFINING ECONOMICS

Currently there is an over-supply of used oil in Alberta. Used oil has little or no value to the western Canadian consumer. Low prices for natural gas and propane, which are cleaner and easier to burn, create little incentive to utilize used oil even for its heating value. The current low value of used oil in the market place has resulted in collectors having to pay for used oil removal.

Market factors controlling the virgin base oil production cost and sales also affect the re-refiners since the re-refiners generally must produce their oil at a slightly lower price.

Current low crude oil prices have resulted in the re-refiner's base oil production costs being very close to the cost of the virgin base oils produced by Alberta refiners (Monenco, 1989). This has resulted in Alberta's re-refining industry being only marginally profitable at this time. Figure 6 provides an estimate of the current markets of Alberta re-refiners.

Sales markets appear to be one of the major constraints to increasing the amount of used oil being re-refined in the Province. Some of the factors limiting expansion of the market for re-refined products include:



ESTIMATE OF ALBERTA REREFINER MARKETS 1990

NOTE: AFTER MONENCO CONSULTANTS LTD. 1988 (UPDATED)

FIGURE 6

- an efficient and effective collection system;
- the public must be convinced that the quality of used oil after re-refining is of comparable quality to base oils derived from virgin crude oil, thus providing a market demand for re-refined oil; or
- the refiners who sell virgin base oil must give up part of their market share to the re-refiners.

Reprocessing

In reprocessing, relatively simple physical/chemical treatments such as settling, filtration, dehydration, coagulation and centrifugation are used to remove the basic contaminants from used oil. Reprocessed oils are used most commonly in industrial applications. Canadian Oil Reclamation Ltd. (COR) in Red Deer is the largest oil reprocessor in the Province. COR has an extensive collection system with depots in Grand Prairie, Edmonton, Red Deer, Calgary and Raymond/Lethbridge. Most of the used oil reprocessed by COR is sold as a bunker fuel to asphalt plants. It is estimated that COR will reprocess between seven and eight million litres of used oil in 1990.

Cement Kilns

In March 1989 the Canadian Portland Cement Association published a document titled "Resource Recovery: The Cement Kiln Solution", which advocates the use of liquid wastes such as used oil as a supplemental fuel for cement kilns. The publication notes that the high temperatures and long residence time ensure waste destruction efficiencies of greater than 99.99 percent. Due to these factors, plus the natural gas scrubbing action provided by the limestone in the cement, used oil can be burned in cement kilns without many of the negative air quality effects normally associated with burning used oil in small to medium sized boilers.

Portland cement is produced by heating a mixture of limestone and clay or shale to a temperature of at least 1450°C, which forms a clinker. The clinker is ground and blended with five percent gypsum to form cement.

Cement manufacturing is energy intensive and fuel generally accounts for 20 to 25 percent of the manufacturing costs. There are two facilities in Alberta operating rotary kilns to produce cement: Inland Cement Ltd. in Edmonton and Lafarge Canada Inc. at Exshaw. Both of these facilities use natural gas but are now evaluating used oil as an alternative or supplemental fuel. In July 1990, Inland Cement Ltd. conducted a three day test burn utilizing used oil as a fuel in order to evaluate air emissions and general operations. If the results of this first test are successful a longer 90 day test burn is planned.

As a result of the test burn, the two re-refiners in Alberta have raised the concern that their feed stock will be depleted if the two cement facilities in Alberta decide to utilize used oil as a fuel. It has been estimated that the two facilities are capable of using all of the 50 million litres of used oil generated annually in Alberta. However, from Alberta Environment's perspective, the air quality monitoring results from the test burn will allow an assessment of the environmental acceptability of this disposition option and will assist in the development of a long-term management strategy for used oil in the province. Verifying various disposition options is considered necessary since the current annual re-refining capacity in Alberta is estimated to be 28 million litres, below the 50 million litres that could potentially be collected.

Road Oiling

Used oil has been applied to gravel roads in Alberta and Canada as a dust suppressant for many years. Road oiling is still popular in

Alberta because of the current over-supply of used oil. It is reasonably effective as a dust suppressant and it is economical.

There have been concerns for some time that the harmful constituents in used oil may contaminate soil and local groundwater supplies. A number of studies on the environmental effects of road oiling have shown that the impact of the practice is determined by a variety of factors including oil properties, soil type, meteorological and traffic conditions.

One of the most recent studies conducted by the United States Department of Energy was designed to more definitely characterize the fate of road oil contaminants and the environmental impact of road oiling (Surprenant et al., 1983). The results showed that 12 percent of the applied oil was lost through evaporation and another three to five percent was lost by runoff. It was determined that virtually all of the oil left in the soil was retained within the upper centimeter of the road surface. The water soluble component of road oil was determined to be very small.

Other studies have shown less favorable results. The variations in study results appear to be due to differences in soil density and road preparation. The U.S. Department of Energy investigations acknowledged that environmental contamination could result from the use of contaminated road oils, but their results suggested that the environmental impact of road oiling is not overly severe. However, considering the higher order of uses available and the potential for contamination if contaminated oil is used or applied to permeable, poorly prepared road beds, road oiling is being discouraged in Alberta.

CPPI USED OIL ACTION PLAN

A report released on March 20, 1990, to member companies of the Canadian Petroleum Products Institute (CPPI) acknowledged that the petroleum industry must play a strong role in ensuring that used oil is managed. The "CPPI Used Oil Action Plan" makes recommendations on a used oil return and collection system across Canada as well as regional disposition options.

The CPPI has recommended a collection program based upon the principle of "user pay". For the industrial/commercial sectors (including service stations), which constitute 75 percent of the total lube oil demand, the individual generator is responsible for the appropriate collection and disposal of their used oil. The petroleum industry's role is to facilitate and provide support on a supplier/customer relationship, which would appear to be the situation as it is today.

For the DIY/farm sectors a public collection system is recommended, jointly funded by industry and government, and a tax on retail over-the-counter sales to these sectors. It is proposed that the capital requirements for the DIY/farm collection system be funded by a method similar to Ontario's Multi-Materials Recycling Inc. (OMMRI): one third from industry ($15 million), one third from the provincial government ($15 million) and one third from municipal government ($15 million). The necessity for capital funding is based on the Task Force's recommendation that a separate public collection system be established for DIY/farm oil, rather than collecting it through existing tanks at service stations. The reason given for this is that the service station operators are concerned about their liability should their used oils become contaminated by accepting used oil from the general public. The public collection system recommended is a combination of selected depots plus "blue box" curbside collection, where available, managed by government collection authorities. The government is also being requested to accept responsibility for disposal of contaminated used oils collected from the DIY's.

The CPPI also recommends that the provincial and municipal governments provide the ongoing operating costs for the DIY and farm/rural collection systems, estimated at $30 million per year, through a recycling fee on all finished lubricant sales to end users. The recycling fee would be higher on containers of five litres or less (as much as 50 cents/litre), while the remaining sales, in pails, kegs, drums or in bulk would be much smaller (about 1 cent/litre). This would reflect that the operating costs apply primarily to the DIY's.

Other important recommendations from the report are outlined below:

- establishment of a National Used Oil Steering Committee, perhaps through the Canadian Council of Ministers of the Environment (CCME) Management Committee, to implement national strategies and policies for used oil;
- establishment of short-term Provincial Implementation Committees representing all stakeholder groups, to initiate specific provincial plans for collection and reuse;
- a joint industry/government study, involving all stakeholders, to fully evaluate the costs, benefits, and environmental impacts of all acceptable disposition options identified in the CCME Code of Practice;
- a joint government/industry public awareness campaign on the proper handling of used oil; and
- development of legislation/regulations necessary to support the collection system and approved reuse options.

Most of the CPPI's recommendations are reasonable; however, whether government is prepared to take any responsibility for the funding or management of the used oil collection and disposition system, including the collection and management of recycling fee, has yet to be determined.

CONCLUSION

Currently, there is an over-supply of used oil in the Province. It has been estimated that 40 percent of the recoverable used oil in the Province will be re-refined in 1990. In addition, it appears that approximately 40 percent of the recoverable used oil is being disposed of in an unregulated manner, including discharge to landfills, sewer systems and surface waters.

The improper disposal of used lubricating oil is a major environmental concern due to the potential for surface water, groundwater and soil contamination. Therefore, increasing the amount of used oil being recycled in Alberta and other provinces is an important element in the protection of Canada's environment.

Today, the re-refining industry is only marginally profitable due to the small difference between the re-refined base oil production cost and the sale price of the finished product. A study recently commissioned by Alberta Environment on the economics of re-refining used lubricating oil in Alberta has identified the lack of markets as the major constraint to increasing the amount of used oil being re-refined in the Province. Alberta Environment is taking the following initiatives to enhance recycling of this valuable non-renewable resource:

- a procurement policy is being drafted which will give preference to the use of re-refined oil in Alberta government vehicles. Although lubrication sales to the Alberta government represent a small percentage of the market, it is hoped that the publicity and endorsement value of using re-refined oil will encourage other consumers;

- "buy recycled products" education campaign is planned as part of Alberta's proposed Comprehensive Waste Minimization/Recycling Program; and

- work with the Canadian Petroleum Products Institute to establish a used oil return and collection system across Alberta and establish regional disposition options. To promote prompt action to implement this process, Alberta Environment has agreed in principle to the appointment of a Department representative to the proposed Used Oil Committee and the development of supporting legislative requirements.

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"A USED OIL RECYCLING PROGRAM FOR CANADA"

BY
THE CANADIAN PETROLEUM PRODUCTS INSTITUTE (CPPI)
OTTAWA, CANADA

PRESENTED BY
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NATIONAL USED OIL COORDINATOR
CPPI

INTRODUCTION

I am here today as a representative of Canada's petroleum refining industry, the Canadian Petroleum Products Institute, or CPPI as it is known. Today I would like to outline the elements of a used oil management program that we recently initiated.

With start-up costs of $45 million, and on-going management costs of $30 million, this is a major public initiative. It will, however, introduce a national used oil collection program to industrial users, and to over 4.5 Million households in Canada.

As we all know, oil plays a vital role as a lubricant for machinery: combine harvesters, chain saws, car engines - the list is endless. And everywhere machines are found, used oil is generated.

Our concern stems from the fact that oil can be contaminated by a variety of toxic chemicals, and heavy metals such as lead, zinc, cadmium and others, during use. Improper disposal of this used oil is creating a widespread pollution problem. The problem is not well known generally, because used oil pollution is not concentrated in one area, it is everywhere. And because of the volumes involved, it is a serious concern.

It is estimated, for example, that Canadians use about one billion litres of lubricating oil each year. At least 500 million litres of this oil is consumed during use, the other 500 million litres is potentially recoverable. Unlike many other wastes in society, if it can be recovered, oil can be reused.

Unfortunately over half of this potentially reusable oil cannot be accounted for - it is dumped into the environment each year. To give you an idea of the size of the problem - and our concern - we are talking about 250-300 million litres of oil improperly disposed of. By comparison, the Exxon Valdez spill accounted for some 40 million litres.

Because of a lack of awareness of the environmental damage created by used oil, the lack of regulations enforcing recycling, and the general inconvenience involved in returning the oil, recycling has been sporadic.

ISSUES REVIEWED BY THE CPPI TASK FORCE

This indiscriminate dumping is a major concern to the member companies of CPPI because of the environmental threat it poses. However, we also know that there is the potential for recovering this oil, with a proper, comprehensive collection system in place. So the

Institute created a task force last fall to examine the possibility of mounting a national used oil recycling program. Our action plan is the result of this investigation.

Our task force recognized at the outset that the used oil issue is complex and involves many players. Canada, being a federal state, has both federal and provincial legislative requirements, and standards that apply to the collection, reuse, and disposal of petroleum products. Municipal authorities are also involved because they often manage waste collection services.

Clearly, the industry could not expect to resolve the used oil problem by itself. The solution required the formation of partnerships with everyone involved, including: all governments, oil manufacturers, retailers, industrial users, do-it-yourself oil changers, used oil collectors, recyclers, and other reusers.

Our task force estimated that up to 70 percent of the used oil generated by the do-it-yourself consumer could be recovered. With appropriate provincial regulations in place, the task force also concluded that up to 90 percent of used oil could be recovered from large and small industrial users such as: fast lube stations, service stations, car dealers and others.

We determined that there were three critical aspects to used oil management.

First, a system needed to be developed to collect the used oil.

Second, a network of recycling and reuse outlets was needed to handle the collected volumes.

And third, both needed to run concurrently - we cannot afford to have the one without the other.

Our task force prepared a used oil action plan which was accepted by the CPPI Board of Directors last March. The plan has 21 recommendations for used oil collection, recycling, and reuse. We are now moving ahead to start implementing the plan across Canada with the support of federal and provincial governments.

BASIC OPERATING PRINCIPLES

There are five guiding principles to our action plan:

First - and most important of all - the CPPI Board of Directors agreed that all those who sell or dispense lubricating oil have a responsibility to encourage its collection.

Second, we need to mount an education campaign to change consumer attitudes to encourage recycling, and to accept recycled oil products.

Third, we need to encourage the do-it-yourself oil changer in urban and rural areas to return used oil to acceptable locations.

Fourth, we need to develop effective systems for collecting, accumulating, and recycling or reusing all available used oil in an environmentally acceptable manner.

And finally, we believe the establishment of enforceable regulations in each province would help to define the acceptable methods of used oil collection, return, and disposal.

Given the highly competitive nature of the petroleum industry, it was a major achievement to have industry leaders achieve a consensus on the **Used Oil Action Plan**, and to endorse these principles.

I would now like to review for you the key elements in our action plan.

COLLECTION AND TRANSPORTATION OF USED OIL

Our first concern was collecting the oil. Clearly, the ease of recovering used oil relates to the sector that generated it. While large and small industrial sectors can be handled by expanding existing collection networks, the do-it-yourself market poses unique problems. Past experience has shown that encouraging consumers to voluntarily deliver used oil to corner service stations and quick lube stations has failed. In part, it is an inconvenience to the consumer, when compared to putting the oil out with the trash. But also, service station owners have been reluctant to undertake collections for two reasons.

First, there is the cost involved in having the oil taken away. And secondly, station owners do not want to accept liability for receiving contaminated oils from consumers when they have the legal responsibility to dispose in a manner acceptable to governments. As some owners will tell you - disposing of contaminated used oil can be hazardous to one's budget!

We have recommended that the collection program for individual urban and rural consumers be based on the establishment of collection depots, plus the use of a curbside "blue box" collection system in neighbourhoods.

We expect that when fully operational, curbside collections would extend to some 4.5 million canadian households.

This would be identical to the system being widely used now to collect glass and paper for recycling. We believe that there is less risk of contamination with this "doorstep" system. The cooperation of all our provincial governments is required, however, to ensure that the collection system is widespread and convenient for all; that the liability and hazardous waste concerns of collecting agents are resolved through legislation; and that public promotion programs are used to encourage usage.

RECYCLING REUSE, AND DISPOSAL

Following the collection of the used oil, the next issue was to determine how to dispose of it. The Institute accepts the fact that re-refining the used oil collected would be the ideal method of recycling this resource. It is worth mentioning that Canada has the world's largest capacity for re-refining oil. However, facilities for doing this work are not available in all parts of Canada, and our current capacity is not adequate to process the amounts of used oil that will be recovered.

So, other environmentally acceptable methods of reusing or recycling the oil have to be used. These would be in keeping with the principles of sustainable development by either recovering the used lubricating oils as re-refined or reprocessed oils, or by capturing their heating value as fuel. In some cases the oil could be cleaned for reuse, turned into industrial lubricants, or used as refinery feedstock for products like asphalt.

In all cases, it would be the mandate of a designated "provincial collection authority" to determine what reuse options would be acceptable in each area. This calls for striking a balance among the capital and operating costs associated with each option, and acknowledging the preferences of the Canadian Council of Ministers of the environment. This council has declared a strong preference for re-refining or re-processing used oil. Followed by other options such as: fuel for cement kilns; or fuel for industrial boilers.

These options need to be reviewed carefully to determine what options are most suitable to each region. We have proposed that governments join industry in cooperating in a major, independent consultant's evaluation of the situation. The study could review all costs, benefits, and environmental impacts of all proposed recycle and reuse options. This would assist provincial authorities in establishing their approved current, and future, disposition options.

PUBLIC AWARENESS

As with all recycling campaigns, consumer education and awareness create success stories. Many lubricant users now understand the importance of handling used oil properly, and are sensitive to the health and environmental concerns. But no large-scale program has been directed at the do-it-yourself consumer. Product literature, advertising, information hotlines, and many other communications options can be used to deliver a positive message to Canadians about the value of oil recycling, and instill a concern so that their own small volumes are properly recovered and returned.

The experience here in Canada, has shown that public collection campaigns stimulate participation, and an interest by the public in having government or other public authorities come forward with more recycling options. In tandem with general information, we also need to provide advice on how to properly collect and deliver used oil to collection facilities. For example, this could even include providing containers with child-proof caps for public safety.

PROGRAM FUNDING

As with all environmental initiatives, funding is a major concern for all parties. Capital investment is required to establish collection facilities and operating funds to manage the program.

Our task force has estimated that the capital investment to start the program nationally will be $45 million, spread over a five-year implementation period. The industry's contribution will be $15 million, or $3 million per year.

Using the accepted formula of cost-sharing already in place for existing "blue box" collection systems, the remaining two-thirds would come from the provincial and municipal governments. This would work out to a one-time investment, equal to about three cents per litre on sales for one year.

This is to get the program started. We estimate that the investment required to manage the program will be $30 million annually. This will cover collection, transportation, disposal, public education, and administration expenses. This investment would be covered by the provincial governments. To offset this cost, and in keeping with the principle that the polluter should pay, we have suggested that the on-going investment could be recovered through a surcharge on over-the-counter sale of lube oil ranging from 15 to 50 cents per litre. At the low end, this could cover the operating costs, a higher surcharge could cover both the investment and operating costs.

These proposals are now in the process of being discussed with the provincial governments.

INDUSTRY INVOLVEMENT

I would like to outline the obligations that the industry will assume in putting this program into place. The CPPI recognizes the petroleum industry's responsibility to ensure the management of used oil in an environmentally acceptable manner. The industry is playing a leading role in making our action plan a reality. To do so, we will be involved in the following five ways.

First, we will ensure that oil producers and industrial users take responsibility for the collection and handling of their used oil.

Second, we will work with government to establish consumer collection systems.

Third, we will share the capital costs of the consumer collection system.

Fourth, we will create a public awareness program to foster support for used oil collection.

And finally, we will work to evaluate and develop environmentally acceptable recycling and reuse options for the oil collected.

By providing this support, in addition to the Institute' resources in each region, cppi will provide the leadership, commitment, and facilities necessary, on behalf of our member companies, to actively encourage and participate in the collection of used oil.

GOVERNMENT INVOLVEMENT

The other major partner in this enterprise is government. We have identified the following six needs:

First, we see a need for government legislation, regulations, and enforcement to ensure that all parties who generate used oils also manage them in an acceptable manner. While the members of our Institute represent most of the oil refiners in Canada, not all are represented, and we do not represent all oil retailers.

To have a level playing field, all parties involved must abide by the same rules.

Second, we also see a need for government-industry participation in a public awareness campaign.

Third, to encourage collection, government assurances are required that the independent agents who collect and transport the oil will not be held liable for any contaminated oil picked up in the system.

Fourth, as mentioned earlier, governments have a role to play in providing partial funding for the program, and encouraging cost-recovery through whatever funding mechanism is deemed acceptable.

Fifth, we hope that governments, working with industry, will establish an approved list of recycling and reuse options. Such a list, we expect, would be updated to reflect changes in technology and other circumstances.

Finally, CPPI recommends that governments need to participate with industry in the creation of a network of action groups to help implement used oil collection on a national, provincial, and municipal basis. Once started, provincial "collection authorities" need to be identified to handle the on-going management of the program.

IMPLEMENTATION

This CPPI action plan was approved by our Board of Directors last March. We are now working quickly to implement the system. Our schedule calls for 15 percent of the collection system to be in place by year-end. To do this, we have created a National Steering Committee, comprised of industry, federal, and provincial representatives to guide the program's strategic development. At the provincial level we will establish an implementation committee for each province to handle the tactical problems involved in developing a provincial implementation plan. At this level, the players involved would be: the industry and CPPI representatives, provincial government representatives, waste management officials, oil collectors, rerefiners, and public interest groups. It is essential, of course, to have broad participation in order to gain widespread support.

To date, we have had successful meetings with the federal government and the provincial governments. With their continued cooperation and support, we expect to achieve our overall target of 100 percent implementation by the end of 1994.

CONCLUSION

In conclusion, I expect that our initiative will influence public attitudes towards the collection of used oil, and perhaps stimulate even more reflection about other conservation initiatives for the petroleum industry.

Thank you for your attention. I would be pleased to answer any questions.

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CPPI Used Oil Action Plan

Introduction

Why?

- Toxicity
- Widespread pollution
- Used oil recoverable
- Save resources
- Protect environment

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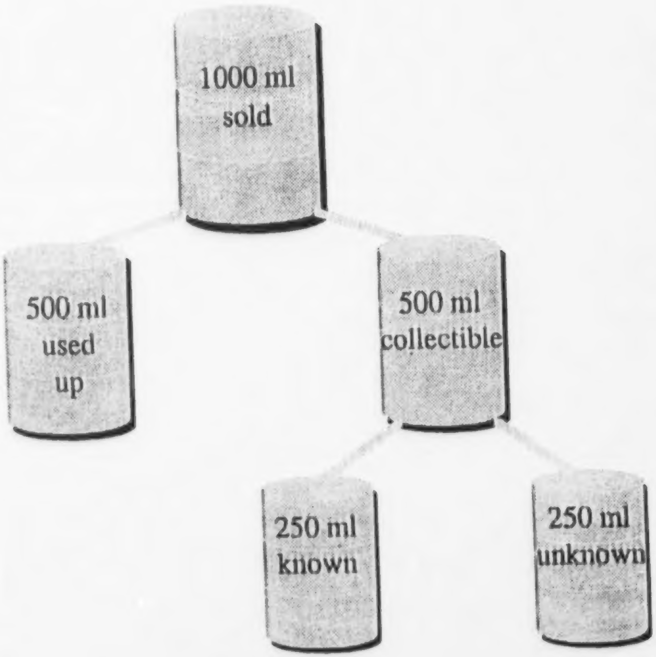
Canadian Situation



1000 ml
sold

500 ml
used
up

500 ml
collectible

250 ml
known

250 ml
unknown

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Used oil generators can be grouped into 4 categories:

Group 1 – DIY's and small industrial truckers
Group 2 – Farm, rural, remote generators
Group 3 – Large industrial users
Group 4 – Small urban generators

- service stations
- repair shops
- fast lubes
- car dealers
- small industries
- etc.

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Expected Recovery

		M. Litres
Potential Recovery		
	Group 1 + 2	140
	Group 3 + 4	285
		425
Recovery Today		
	Group 1 + 2	25
	Group 3 + 4	150
		175
Action Plan		
	Group 1 + 2	95
	Group 3 + 4	255
		350

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Operating Principles

1. Accept responsibility
2. Change attitudes
3. Encourage consumers
4. Develop methods
5. Promote regulation

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Key Elements

1. Collection and transportation
2. Recycling, re-use
3. Public awareness
4. Program funding
5. Industry involvement
6. Government involvement
7. Implementation

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Recycle/Reuse Options

- Current capacity
- Acceptable/unacceptable options
- CCME code
- Industry/government evaluation

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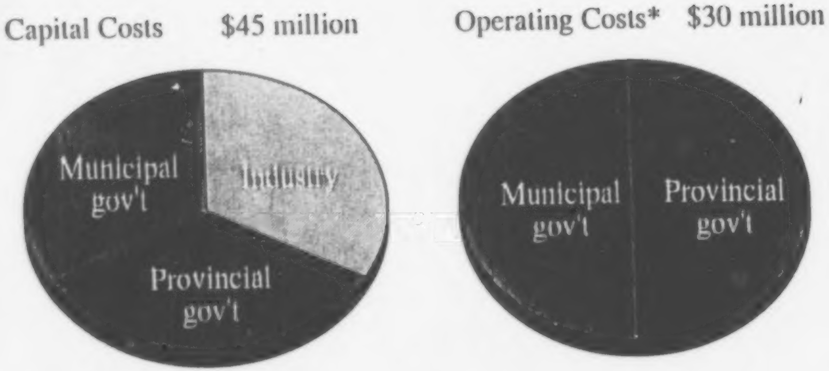
Program Funding


Capital Costs $45 million

Operating Costs* $30 million

*Oil surcharge could recover costs

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Industry Contribution

• Task force	$150K
• Capital investment	$15M
• Coordinator	$200K/annum
• Study of reuse options	$100K

- Provincial implementation
- Provincial mgt. committee
- Public awareness
- Packaging/labelling
- Industry/liaison

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Government Contribution

- Joint evaluation study
- Program funding
- Procurement policies
- Public awareness
- Program management
- Legislation/audit

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Program Management

- National Steering Committee
- Provincial Implementation Committee
- Provincial Used Oil Management Committee
- Provincial Collection Authority

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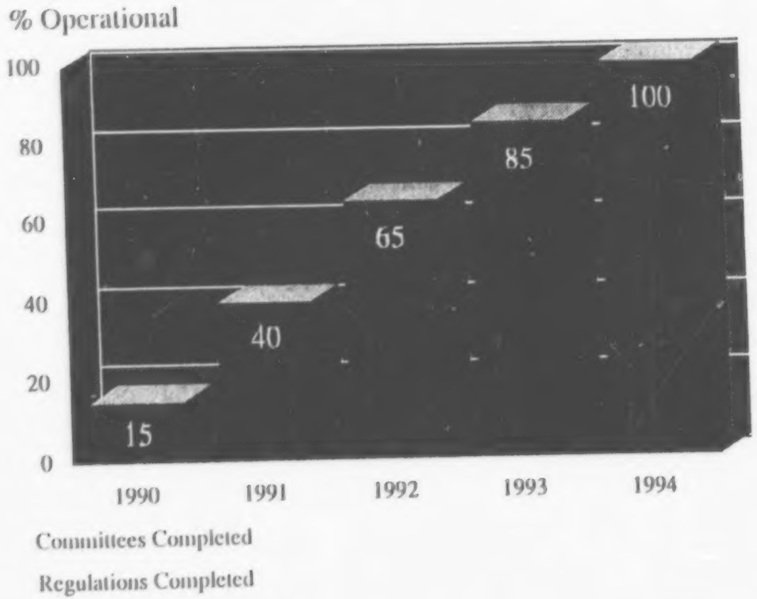
Implementation



Recycling Paint from Household Hazardous Waste

Claudia Marsales, Laidlaw Environmental Services Ltd.
Toronto, Ontario

Paper unavailable at time of printing
Texte non reçu au moment de mettre sous presse

AN ACTION PLAN FOR WASTE MINIMIZATION IN MANITOBA

by

Dr. Robert Fenton, Department of Economics, University of Winnipeg;
Jerry Spiegel, Jim Ferguson, Rod McCormick, Manitoba Environment

INTRODUCTION

In June of 1989, the Manitoba Minister of Environment, the Honourable Glen Cummings, set up the Manitoba Recycling Action Committee. Mr. Cummings asked the Committee to advise him on how the Province should meet a goal, set for the year 2000, of a 50 percent reduction in solid waste generated in the province. The terms of reference were very broad, but the main point called for the Committee's strategic action plan to include the "4-R's" of waste minimization: Reduce, Reuse, Recycle and Recover. The Manitoba Recycling Action Committee had fourteen members representing a broad spectrum of stakeholder interests, including; the packaging, soft drink, and recycling industry, the Chamber of Commerce, municipal representatives from Winnipeg, Brandon, Thompson and the Manitoba Association of Urban Municipalities, and representatives of NGO's — the Recycling Council of Manitoba, the Manitoba Eco-Network, the Mennonite Central Committee and the Consumers' Association of Canada.

PUBLIC CONSULTATION

The Minister's instructions called for broad consultation with both the general public and key stakeholders, to work towards a consensus on the Committee's recommendations. Consensus was reached on many aspects of the fifty-six recommendations presented to the Minister. The representatives of the packaging industry and the soft drink industry provided dissenting opinions about a few particular recommendations.

The Committee received the views of the public at a series of Town Hall Meetings held in the fall of 1989. About 800 persons discussed concerns and priorities with the Committee during several meetings at various locations in the province. A draft strategy was developed and reviewed in March 1990 at the Conserving Our Future Conference, sponsored by the Committee. This conference provided an opportunity for the Committee to hear the opinions and suggestions of the public and industry stakeholders on the draft strategy. The Conference was well attended with over 450 in attendance.

The open consultative nature of the Committee's deliberations was very useful. It was the Committee's opinion that subsequent stages of policy development and implementation should also be done on a consultative basis. The first recommendation of the Committee was that the Minister of Environment continue to use a multi-stakeholder approach to implement the measures called for in the Action Plan Strategy. It was emphasized that the principle of broad consultation and multi-stakeholder negotiation underlay many of the Committee's recommendations.

THE BASIC STRATEGY

The basic strategy of the Action Plan is to ensure that individuals and groups in society accept their responsibility for waste minimization. Government is also responsible for minimizing its waste and is accountable for ensuring that the rest of "us" accept our responsibilities.

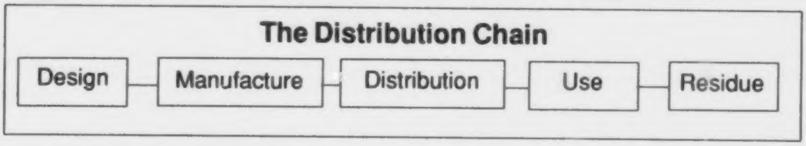
The Strategy is designed to achieve the Minister's goal of 50 per cent reduction of waste before 2000. This is defined as a 50 per cent reduction in the per capita flow of waste to the landfill by 2000 compared to the 1988 flow. The Committee recommended that waste reduction be made a continuing goal. The 2010 per capita flow of waste to landfill would be set before the year 2000.

The distribution chain, or the people and companies who sell products in Manitoba, are asked to accept the responsibility for waste minimization for that product. The responsibility is aimed at "the distributor/brand-owner of a product in Manitoba". This includes products manufactured outside the province but sold here as well as those manufactured and sold in Manitoba. Manufacturers of products destined for sale outside the province would be responsible for the waste generated in Manitoba. Wastes such as household yard wastes and wastes collected by government from parks and greenspaces, which are normally sent to a landfill, will be the responsibility of the government collecting them.

The emphasis of the Strategy has been broadened to waste minimization and highlights the priority to be given to source reduction of waste and to reuse activities. Recycling is a valuable process for wastes which have not been reduced. Recycling has a cost in terms of both money and resource and should not be wasted in unnecessary activities.

The Strategy calls for each distribution chain to achieve a specific waste reduction target in order to contribute to the overall goal. Targets for broad product groups will be negotiated between the stakeholders and the government. The Strategy provides for the filing of distributor waste minimization plans and has provision for interim targets, incentives, compliance evaluation and for penalties. The distributor accepts responsibility to reach the target by a combination of source reduction, reuse, recycling, or recovery activities best suited to their product. The combination will be agreed upon in the waste minimization action plan (Distributor Action Plan) filed with the Department of the Environment.

The focus on the year 2000 and the emphasis on responsibility of the distributor gives the Action Plan a longer term view. Several priority products and product groups have been identified for early action. Transitional arrangements to make use of the broad public support for waste minimization were also identified. In parallel with the appointment of the Recycling Action Committee, the Government of Manitoba introduced The Waste Reduction and Prevention Act (WRAP Act). This Act provides the Government with many of the powers required to implement the type of strategy called for by the Action Committee. The WRAP Act has been proclaimed effective August 31, 1990.


The Distribution Chain

WASTE REDUCTION GOAL

The Committee interpreted the 50% reduction goal to mean that by January 1, 2000 the amount of waste generated per person in the province shall be 50% less than it was in 1988 — about 500 kilograms per person rather than the approximately 1000 kilograms per person at the present time. This includes municipal solid waste from all sources; residential, commercial, industrial and municipal. The weight of materials discarded shall be the basis for the evaluation of the achievement of the goal.

The Committee's opinion was that waste reduction should continue beyond the year 2000. Conditions in the year 2000 will determine whether a different waste reduction goal is desirable for the year 2010. The important feature is to establish an on-going perspective so that waste reduction becomes an integral part of a sustainable development strategy for the Province in which environmental and economic planning are truly integrated.

The Committee's proposal moves the Province beyond a limited set of recycling objectives and toward a Waste Minimization Strategy. This advancement is consistent with current thinking on the issue. For example, Metropolitan Toronto in May 1988, received a recommendation for two distinct but compatible strategies — a Waste

Reduction Strategy and a Waste Recycling Strategy. These strategies are designed to move Toronto beyond the existing curbside collection programs that are now under way in the region.

The report of The Ontario Recycling Advisory Committee, January 1989, includes a major section entitled, "Guiding Principles for Development of a Comprehensive Recycling Strategy". An important Guiding Principle is waste reduction and minimization. Thus, a Waste Minimization Strategy in Manitoba would be called a Comprehensive Recycling Strategy in Ontario.

Across Canada there exists a common concern about minimizing waste and most provinces are examining a change of policy in this area. The report of the British Columbia Municipal Solid Waste Management Task Force, March 1989, called for that province to adopt Reduce, Reuse, Recycle, Recover and Residue management as its objectives.

With waste minimization as the basis of our goal, actual measurements may be taken to evaluate progress toward, and achievement of, the 50% reduction in waste. Measurements taken at the landfill gates can determine the per capita weight of materials being deposited there. If the volume approximates 500 kilograms per capita in 2000, the goals of the Strategy will have been achieved. Additional information on municipal expenditures on litter control, the extent of illegal dumping, and unlicensed dumping sites will also be useful. The major criterion for judging success will be the per capita weight of materials being landfilled.

A number of criteria presently being used in other jurisdictions to describe the success of recycling programs will not be appropriate for the Manitoba situation. Numbers of households participating in curbside collection, numbers of vehicles dropping materials off at collection depots, and the percentage of containers returned for deposit or bought back at redemption centres will be interesting descriptors of the process, but will not measure the success of the program.

By focusing on waste reduction goals and accomplishments, those held responsible will be able to choose among source reduction, reuse, recycling or recovery as the preferred methods of achieving the required reduction in per capita waste generated. The chosen mix should represent the most effective method of achievement in terms of costs, impacts and diversion levels. Environmental monitoring and assessment of these activities will be important as they are for any other element of economic activity.

Important to remember is that the 50% waste reduction is a goal not a ceiling. Waste reduction is a major requirement for both economic efficiency and environmental efficiency and will be a major focus for a sustainable development strategy. A notional waste reduction goal for the subsequent decade will remind us to strive for additional waste reduction even if the 50% goal is reached before 2000.

The goal of a 50% reduction by the year 2000 will seem distant and inadequate to environmental activists who desire immediate short term results. However, the changes being sought are major and fundamental revisions to the way in which Manitobans behave. In order to accomplish these revisions, changes must be made in existing infrastructure and facilities, new facilities must be built and new technologies will need to be developed.

There are risks in pushing ahead too quickly on the easily accomplished portions of the task, such as collection of recyclables, without first addressing some of the harder portions, such as developing new processing technologies and expanding markets for secondary materials. These risks are amply displayed in some of the curbside collection programs implemented in Canada and the United States which have overwhelmed the available markets with the volumes of material collected and in some cases contaminated the processing system with poor quality materials. The results have been additional cost, confusion, and in some instances, disillusion with the viability of recycling and waste reduction.

An interim goal for 1995 will provide some urgency to the process. It will encourage us to undertake steps that could have a significant impact in the short-term while providing a measure of progress toward the longer-term goal. The Committee proposed that an interim goal of a 20% reduction of the 1988 per capita waste levels by January 1, 1995 be set to encourage early activity while giving time to develop the facilities required to accelerate waste reduction achievements between 1995 and 2000.

WASTE REDUCTION TARGETS

In order to plan for the achievement of the waste reduction goals, the Strategy calls for specific waste reduction targets to be established on one of the following bases:

- For particular product groups or industries, e.g. food and beverage, paper products, automotive products;
- For specific materials, e.g. glass, office paper, plastics, metals, yard waste, or;
- For some combination of materials and product groups.

The Strategy uses a combination of product group and material based targets to help achieve the waste reduction objectives. Waste flow analysis will be required to fine tune the targets and to measure success in meeting the targets.

Targets should be set by the provincial government through consultation and negotiation with interest groups. The basic model for joint protocols of this type includes the national and provincial Round Tables or the National Packaging Protocol. In some cases, various groups may declare their own targets. Of course, if these methods do not work, or are not acceptable, the committee recommended that government may reserve the right to unilaterally impose targets and/or systems to achieve them.

A fundamental point of agreement for the Committee is the principle that the polluter should pay for abating pollution and that waste is a form of pollution. Rather than having tax-payers take responsibility for all aspects of waste minimization, it is crucial that the distributors of products in Manitoba take responsibility for the wastes associated with those products, if "polluter pays" is to be realized.

The committee uses the term "distribution chain" to describe the activities which provide the products of our economy. This chain stretches from the product designer to the ultimate user and includes both household and business consumers.

Within the distribution chain there are many transactions and different companies. One part of this chain, "the distributor", will be chosen as the agent responsible for achieving the targets established for products sold through the chain. The cost of achieving any reduction will be borne by the members of the chain, including consumers, according to the competitive forces within the chain.

The definition of the distributor is flexible to meet the needs of a range of product groups. The distributor is most likely to be the brand-owner or licensed brand user in the province. In some cases, the distributor could be the retailer or wholesaler of the product, particularly where the distributor is the direct importer of the product.

As an example of the first case, several national brands of automotive products are distributed through a network of retail franchises. In this case, the national brand-owner, not the retail franchisee, would be responsible for meeting the reduction targets. For some of these products, the brand-owner will be the manufacturer. In many cases, the brand-owner will not be the manufacturer. Obviously, automotive products are not the only product sold this way — hardware and building materials, fast food products, and appliances also use this distribution chain model.

The major department store chains and supermarkets illustrate the second case. Many of the products sold through these chains are nationally branded products with an identifiable "brand-owner". In this case, the retail chain is not the distributor. Many brands of similar or competing products may have the same brand-owner and a common distributor is therefore responsible for the waste associated with the product. On the other hand, these retail chains each have their own private brands for which they are the brand-owner and therefore the "distributor" identified under the Strategy.

Targets would be established for product or industry groups, on the basis of priorities identified by waste stream analysis. The Committee proposed that the analytical criteria include:

- The proportion of the waste stream, either by volume or weight;
- Toxicity in the waste stream, including chemical, bacterial or viral;
- Special problems with landfilling;
- Public concern;
- Ease of waste reduction via the "4-R's";
- Environmental intensity including energy use, material content, etc.

Using these criteria it would be possible to evaluate priorities, not just for high volume waste, but also for smaller waste stream components which have special costs on society. These criteria include:

- Toxicity associated with residue;
- Behaviour in a landfill over time;
- Contribution to litter problems;
- General nuisance;
- Value or other characteristics.

Rubber tires, batteries, lubricating oils, fast food and beverage containers, disposable diapers and advertising flyers are commodities fitting one or more of these categories.

After some experience, the target setting process could be enhanced to provide different weights for selected criteria. A higher weight might be desirable for products currently achieving high diversion rates so that valuable materials are not lost (e.g. soft drink and beer containers, etc.).

To facilitate negotiations between the government and stakeholders, the Committee agreed to the following terms regarding targets:

- High targets mean a reduction of between 65% and 85% of present levels;
- Medium targets are between 45% and 65%;
- Low targets mean a reduction of between 25% and 45%.

Precise specifications will be written into regulations under the WRAP Act. The regulations would have to ensure that a "level playing field" is achieved for similar products. Although one agent will be designated responsible, in actual fact the responsibility will be shared throughout the distribution chain.

A STRATEGY FOR MANITOBA

The Strategy calls for the Manitoba Department of Environment to prepare a list of priority products for waste minimization. The list would be expanded over the decade until, ultimately, all components of the waste stream are included. The criteria used for the initial list of priority products should be similar to the criteria discussed above for establishing waste reduction targets. This list would be released by Manitoba Environment not later than January 1, 1991.

Distributors of products in Manitoba with an annual provincial sales volume above specified levels would be required to develop Distributor Action Plans to minimize the wastes from those products. The exact threshold levels would be negotiated with stakeholders while setting waste reduction targets. The Distributor Action Plans would describe a program to attain the waste reduction targets. Distributor Action Plans would be required to be filed no more than 18 months after the publication of the priorities list, although in some cases much less time will be required because of existing plans, programs, or opportunities.

Governments must develop plans to reduce the waste associated with the products they distribute, as well as for yard and food wastes. New products would be compared with the priority list at the time of introduction and may be required to meet the targets for their product category.

DEADLINES

Date	Activity
June 1990	Projected Start date
January 1991	Manitoba Environment Identifies Priorities
July 1992	Priority Action Plans submitted by distributors
January 1995	Pre-disposal levies imposed on non-performers

The Committee identified some products and materials to recommend to the Minister as initial priority items based on our deliberations and public consultations. The items on the list include:

- Tires, batteries and lubricating oils;
- Disposable diapers;
- Newspapers;
- Corrugated and commercial papers;
- Yard wastes;
- Beverage containers.

Not all of these items have the same priority and a variety of actions are recommended as a result. It is possible that the Government will have different priorities than those of the Committee. The specifics of the final priority list is the Government's responsibility.

Under the Strategy, the "Distributors" are able to choose the most effective method of achieving the waste reduction target for their products. They might develop their own programs or buy-into established programs. The mix of activities may vary from region to region of the province if that lowers the total cost of achieving a target. For example in remote or northern regions it may make economic sense to compost paper rather than to recycle.

Firms with more than one product in a given product group may create plans based on the entire group of products. For instance an appliance distributor's plan could include the entire range of products sold — stoves, washers and dryers, dishwashers, etc. Special procedures might be included for refrigerators, freezers and air conditioners to recapture the ozone damaging CFC based refrigerants.

The content of the waste action plans is intended to be flexible and could possibly combine a mix of the "4-R's", national protocol considerations, reduction activities by suppliers, along with recycling elements with local contractors. The plans should include performance milestones, evaluation criteria, compliance incentives, and a description of how to implement the plan in all regions of the province. The plans could be updated periodically at the distributors' initiative. Annual Reports to Manitoba Environment would detail progress towards achieving the reduction goals.

To provide an incentive for early compliance with the Distributor Action Plans, the Committee suggested that the province develop a distinctive way to recognize products through public education, perhaps with an honour roll or a distinctive logo. Use of such recognition would depend upon achieving milestones and would be cancelled if the plan did not work. Public recognition would provide a competitive advantage for products with good programs and its use should be reviewed on a regular basis.

After January 1, 1995, products and firms not achieving interim targets or milestones could be assessed a pre-disposal levy. The levy would be scaled according to the level of non-performance and to the importance of the material in the waste stream. The first levy assessment would be as of April 1, 1995 and based on the Statement of Progress filed for the 1994 calendar year. Firms would continue to pay the pre-disposal levy until they achieve their targets and milestones. Firms not filing a waste minimization action plan with a reasonable expectation of achieving the targets and milestones would be required to post a performance bond with respect to the 1995 interim targets.

EDUCATION, THE GRASSROOTS AND CLOSING THE LOOP

The Committee recognized that achieving waste minimization targets would require extensive changes in behaviour — as consumers, producers, distributors, workers, and even as investors. As solutions evolve, it is important that a broad understanding of alternatives is understood. The most widely appealing and understood "solution" of the day may not correspond to the most cost-effective long-term approach to what is a complex set of problems. It is essential that educational materials correspond to the specific development of programs.

Responsibility for conducting a public discussion of issues lies not only with Government, but with all stakeholders, including the media who are the main providers of information to the general public. To ensure that a relatively consistent message is communicated, coordination is essential. Government should work with all those organizations involved in public (adult) and consumer education to ensure that materials and programs are cost-effectively and cooperatively developed and delivered.

The Committee recognized that Manitoba urgently required a waste minimization coordinating agency for implementing its Strategy. Such agencies are a common feature in many provinces and states. The agency could serve as a "grass-roots forum" for province-wide debate of issues and the formation of consensus among the many stakeholders in the Strategy — this will be important for its long term success. The coordinating agency could make existing initiatives and agencies more effective. It could provide educational materials and information to the many individuals and groups anxious to know what to do. It could focus the energies of the many people and groups in the province who want to do something, NOW, to reduce our wastefulness.

Such an agency must be geographically and sectorally representative if it is to be effective. The consumers of Thompson have as much interest in waste minimization as the manufacturer in Boissevan. The church group in Lynn Lake is as anxious to start recycling as is the Winnipeg householder.

It is apparent the Committee's Strategy will take some time to implement — three to five years in some cases. Much of this time will be spent learning about the best system to achieve our objectives and targets in Manitoba. We will need to "try-out" methods that have been used elsewhere and adapt them to our own needs.

The Committee also recognized the need to initiate some short term action particularly in the area of community based programs. The key feature is to make these short term initiatives consistent with the needs of the long term Strategy. To do this, the Committee recommended a tactic of "BUILDING ON WHAT WE HAVE FOR WHAT WE NEED". Short term initiatives would be designed to "try-out" and evaluate possible avenues for achieving the longer term targets and goals.

The "waste minimization coordinating agency" would be helpful in developing criteria to ensure that proper priorities are pursued in providing funding, evaluating specific demonstrations and assessing success or failure. Criteria might include; the time frame of the project, the level of partnership in the sponsoring group, the geographic location, the cost effectiveness of the proposal, consistency with the Action Plan Strategy and the priority given to the waste reduction opportunity.

The Committee also recognized that a central fund to provide financial support for waste minimization demonstration projects could also be helpful in accelerating the development of initiatives. Such a fund could take various forms, but a type of trust fund to which government, business and other groups could make contributions might serve as a useful model. Such trusts have been established already for programs such as wildlife habitat conservation and the disposal of agricultural chemical containers. They fit very well with the concept of trusteeship within a strategy for sustainable development.

The Trust Fund could be administered by an independent Board of Trustees. Contributions to the Waste Minimization Trust Fund would not relieve distributors of their responsibility to achieve waste reduction targets. In this way, the Fund would differ substantially from the Ontario Multi-Material Recycling Inc. (OMMRI) model used in Ontario. A key element of the Fund would be the sponsoring of innovations where it will be valuable to share experiences. The focus of the Fund would not be to provide sustaining funding for projects, but rather to promote the demonstration of new initiatives.

Roles and Functions for the Waste Minimization Strategy

Provincial Government	- define roles - negotiate the targets - monitor the progress - provide technical assistance - provide seed money for infrastructure
Distributors	- meet targets - set price signal for consumers
Grassroots	- utilize waste reduction and recycling opportunities - consume wisely - initiate community basedprogrammes - participate in decision-making
Municipal Governments	- minimize municipal waste - cooperate in landfill consolidation - undertake municipal composting

PRINCIPLES UNDERLYING THE WASTE MINIMIZATION STRATEGY

The principles under which the Strategy has been developed are the 6-R's of Waste Minimization, Sustainable Development and Shared Responsibility. These principles form the basis of the plan and are as critical to its success as the individual details. The 6-R's of waste minimization are the familiar Reduce, Reuse, Recycle and Recover activities, with the addition of Residual management activities and a final "R" of Responsibility. Given the controversy about incineration activities, "recovery" deserves special comment. Recovery includes both composting to recover soil nutrients and energy recovery from waste to replace fossil fuel use.

Despite its significant hydro-electric resources, Manitoba consumes a large amount of fossil fuels for process and space heating uses. In the Committee's view, the recovery of energy from some waste sources as a substitute for fossil fuels is appropriate in some cases. Energy recovery applications might be most suitable for northern locations in which shipment to recycling facilities is not feasible and in which conventional fossil fuels are very expensive. As with all other waste minimization techniques discussed in this plan, the recovery of energy from waste must be done in an environmentally appropriate fashion.

The Committee viewed production of source separated fuels for energy recovery as an acceptable part of its Strategy. The burning of a consistent waste product of known composition permits the optimization of the combustion conditions in the same way as with the fossil fuels which are replaced.

The Committee added two caveats on this issue. First, energy recovery is a fourth priority in the Strategy. Source reduction, reuse and recycling all have priority over energy recovery. The recovery of energy from wastes not suitable for the higher priority techniques is acceptable subject to appropriate environmental safeguards. Second, the energy recovery techniques utilized must be flexible in their fuelling capability. If a source reduction or recycling technique subsequently becomes viable for the waste fuel, then utilization of the higher priority technique is desirable.

Residual management deals with the operation of landfills for the purposes of containing the wastes that can not be diverted by one of the earlier "R's". In thinking of "residual management" rather than "disposal" of wastes, we can see that procedures and even terminology need to change if they are to adapt to new times. Under the Manitoba Environment Act, the provincial government must regulate "waste disposal grounds". The Strategy recommended an increased emphasis on landfill consolidation with appropriate transfer stations that could include facilities for source separation of materials for recycling.

The Committee believes that responsibility for waste occurs at all stages of the product life-cycle: in design, manufacture, distribution, consumption and use, and residual management. At each stage in this cycle, each of us play roles which can contribute to the success or failure of the Waste Minimization Strategy. A key element of the Strategy is that we each accept our shared responsibility for achieving the reduction goal. Consumers, workers, business, educators and governments each have an important role to play. The provincial government has the additional role of holding the rest of us accountable for our responsibilities.

The concept of the distribution chain, stretching from the product designer through the manufacturer to the wholesaler/retailer to the customer and finally to the operator of the residual management facility, helps us to visualize the issue of shared responsibility. What is required is for one key element of the chain in Manitoba to accept responsibility as the focal point for the waste minimization activities of the chain. As discussed earlier, the distributor or brand-owner seems to be the most effective point at which to focus the responsibility. The principle of shared responsibility for waste minimization, arises from the need for stewardship in a sustainable development strategy. A Waste Minimization Strategy for the 1990's should be based on the principle of sustainable development.

Both the sustainable development strategy being prepared by the Manitoba Round Table and the Strategy proposed by the Action Committee take as their basis the statement at the core of the Report of the World Commission on Environment and Development:

> "Humanity has the ability to make development sustainable - to ensure it meets the needs of the present without compromising the ability of future generations to meet their own needs."

This challenge issued by the World Commission is being extended and refined in the work on The Second World Conservation Strategy Project. The Project defines sustainable development as a complex of interacting principles each of which has relevance for development activities: ecological, social, cultural and economic sustainability.

The Waste Minimization Strategy takes its cue from the concept of economic sustainability, although the other three principles must be respected with equal care. The elements of sustainable development as perceived by the Action Committee are: materials and energy efficiency, wise use of natural resources, conservation and stewardship. Each of these elements is important to the achievement of sustainable development and to the achievement of the goal of the Action Plan Strategy.

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Recycling of Newspaper: Receiver Perspective

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GUELPH PILOT SCALE SOLID WASTE COMPOSTER

by

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SUMMARY

The pilot scale composter used by the City of Guelph is described. Operating information and data are limited because of a delay in completion of the plant and numerous startup problems. Some typical waste composition and temperature data are provided to illustrate the process.

INTRODUCTION

Composting may be defined as a self-heating, thermophillic, aerobic, decomposition process. It has been employed since antiquity to stabilize solid organic wastes. Revival of the current interest in the process is the solid waste crisis that most Canadian municipalities find themselves in despite warning by some environmentalists in the sixties and seventies.

In fact because of the impending solid waste crisis in the public and agricultural sectors, the School of Engineering conducted composting research during the late sixties and early seventies. Much of the work was done on composting of poultry manure (Bell and Pos, 1971a; 1971b) but also included composting of municipal solid waste (Bell and Pos, 1973). As a result of this research, a high-rate, 10 m^3/day, manure composting system has been operating on the campus of the University of Guelph for the past eight years. The high quality compost is used to maintain the sport fields, lawns, and gardens of the university.

As part of its future waste management program the City of Guelph is committed to introduce a wet-dry recycling program at a projected cost of $30 million for the facility alone. The wet stream will be composted and the dry stream recycled where possible.

The City has embarked upon a pilot project to study the wet-dry recycling system using presorting of the MSW at the home. The objectives of the program were stated to be as follows (Anon., 1989):

1. To determine the feasibility of achieving a reduction of up to 30% of the waste stream from the pilot area.
2. To develop an organic waste source separation and composting system, and evaluate the effectiveness of the system.

3. To determine the socio-economic implications of the system.

4. To determine the feasibility and effectiveness of implementing a full-scale composting system in Guelph based on the results of the pilot program.

It was also decided that in fulfilling the stated objectives the pilot program is expected to provide the following information (Anon., 1989):

1. The preferred collection system.

2. The performance of the mechanical tipping devices on the collection vehicles.

3. Degree of public participation in terms of cooperation, public perception, and overall public relations between the City and the residents.

4. The quality of source separated materials used for composting.

5. The quantities of compostable material in the waste stream, and the seasonal variations in these quantities.

6. The necessary operating specifications for the full scale plant and the appropriate facility size.

Three groups of homeowners were selected to participate in the project. Each group, consisting of 200 households, has been assigned one of the following three methods of separating the waste:

Three Stream (Group A)	- wet waste (compostable) in green bin - recyclable dry waste in blue bin - non-compostable and non-recyclable waste in regular garbage containers
Two Stream	- wet waste (compostable) plus sanitary napkins, (Group B) disposable diapers, ashes/coals and contents of vacuum cleaner bags in green bin - all dry waste in regular garbage bags
Two Stream	- wet waste (compostable) plus sanitary napkins, (Group C) disposable diapers, ashes/coals and contents of vacuum cleaner bags in green bin - all dry waste in blue bin

The wet (compostable) material includes all food scraps (vegetable and fruit peeling, meat and bones, fats and cooking oils, egg shells, dairy products, coffee grounds, filters and tea bags, and food leftovers) and yard waste (brush, grass clippings and leaves).

The collection program was started in August, 1989 and participation has been excellent. Weekly analyses were performed of ten randomly selected households to characterize the waste and to determine the amount of compostable material. Recently, two groups were added to the program. These are the same as groups A and C, except that coloured garbage bags are used instead of the wheeled bins.

A pilot plant was constructed to compost the material collected in the green bins. The composting facility, which is a hybrid between a static aerated pile and an in-vessel reactor, is operated by the City at its landfill site under the supervision of the consulting engineering company.

The objective of this paper is to present a description of the pilot composter and its performance during the first few months of operation. As such, the paper is more of a progress report than a research paper.

DESCRIPTION OF COMPOSTING FACILITY

The layout of the composting facility is illustrated in Figure 1 and the main components of the system are summarized in Table 1. The system consists of three primary cells (or reactors) and three secondary cells. Each cell was formed by stacking precast blocks of concrete to create a 1.8 m high compartment, open at one end for loading and unloading. The primary cells are 3 m x 3 m and the secondary ones 3 m x 4.5 m. The original design by the City's consultants included a roof to cover the cells but it was not installed for budgetary reasons.

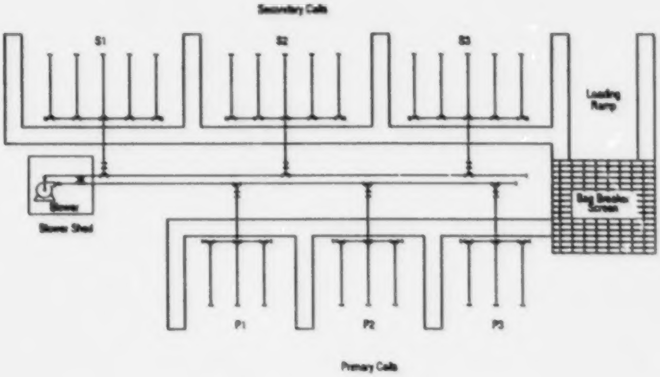

Figure 1. Layout of Composter.

A loading ramp with a bag breaker screen is housed in a covered structure at one end of the cells. At the other end of the facility is the shed containing the air blower and leachage pump, and a 3000 L leachage storage tank.

Aeration of each cell is provided with a network of perforated PVC pipes placed in channels recessed in the base slab. As shown in Figure 1, each primary cell has three parallel pipes and each secondary cell has five parallel pipes for air distribution. A layer of crushed stone was placed on the pipes to prevent plugging and to enhance air distribution through the pile.

The piping network was connected to the blower so that the airflow can be reversed at a time interval controlled by an electronic 24 h timer. The timer was set to reverse the airflow every 6 h using electric valve actuators to turn the four crossover valves in the main airlines. The aeration system is started with air being drawn in through the primary cells and out through the secondary cells for 6 h; after which the airflow through the cells is reversed. It was claimed that this process would prevent air from channeling through the compost piles and maintain distributed aeration without mechanical mixing or turning of the compost.

It was anticipated that each primary reactor would hold about one week's of material. Every third week, a primary reactor would be emptied into a secondary reactor. The 'green' compost would then remain in the secondary reactor for five to six weeks before being placed in open windrows, where it is cured for another five or more weeks.

The orginal schedule required completion of the pilot plant by early fall, 1989 but various delays resulted in a completion date of February, 1990.

TABLE 1. Details of the pilot composting facility.

SYSTEM COMPONENT	DESCRIPTION
Primary cell	3 m wide, 3 m deep, 1.8 m high
Secondary cell	4.5 m wide, 3 m deep, 1.8 m high
Bag breaker screen	area: 4.2 m x 4.0 m hole size: 100 mm x 90 mm
Aeration system	main lines: 150 mm dia, schedule 80 PVC primary cell: 3 parallel, 100 mm dia. PVC secondary cell: 5 parrallel, 100 mm dia.
Blower	Universal Fan & Blower Ltd. - Model FRBJR - Size 208; 2 Hp - 306 cfm @ 14.0 w.g.; 3196 rpm.
Valves	150 mm dia butterfly valves Worcester Controls - electric valve actuators, series 75, four crossover valves
Timers	Aeration direction: 24 h MaxiRex "B" - adjusted in 15 min. intervals Blower duty cycle: Eagle Signals Controls - HQ9 Percentage timer with 15 min. time range and 1% settability

PROCESS DESCRIPTION

The three streams of waste are collected separately in modified garbage trucks and transported to the pilot plant. The wet waste from each group is dumped on the loading ramp in front of the bag breaker screen. All bags are manually opened and the compostable material pushed through the screen. Metals and plastics are removed and sent to the recycling plant, while oversized branches are put through a wood chipper. All excess yard waste is stockpiled for future use.

After the waste from each group (currently only waste from groups A nad C are used becuase group has too much contaminated material) has been processed, it is moved from below the screen to a primary cell with a Bobcat loader. If necessary, the waste from the three groups is mixed and stockpiled yard waste or oversized compost from the secondary cells may be added to the batch to obtain the desired C:N ratio, moisture content, and physical structure. However, because no provisions were made in the original process design to weigh individual quantities of materials or to determine the C:N ratio and moisture content quickly, mixing was done on a volumetric basis using approximate information on the composition of previous waste streams.

The amount of air delivered to each cell may be controlled with the manual valves in the branch pipe leading to the cell and the duty cycle of the blower. After various attempts, a 20% duty cycle (3 minutes of continuous fan operation for each fifteen minute interval) was selected for the batches run in the spring and early summer; however, the cycle was increased to 30% in the summer to prevent anaerobic conditions.

The moisture content of the composting material can be increased by adding either water or leachate using a simple garden sprinkler.

MONITORING OF THE PILOT PLANT

In view of its past interest in composting and current emphasis on environmental engineering, the School of Engineering agreed to provide assistance to the City by monitoring and analyzing the following composting parameters:

1. composition (nutrients, metals, etc.) of the inbound waste and compost;
2. temperature, moisture content, and pH of the composting material;
3. aeration rate; and
4. weather conditions at the site.

At this time, the design of the aeration system prevents the determination of the airflow rate through the cells. Instrumentation to measure the amount and frequency of rainfall, and the wind direction and speed have been recently installed.

Due to the various start-up problems, no analysis of cured compost was available at the time of writing; however, some of the material in the windrow is now ready for analysis.

A. Composition Analysis

The waste material was analyzed to determine the total carbon content, total nitrogen content, nutrient content, volatile matter content, dry matter content, pH, and heavy metal content (cobalt, chromium, copper, manganese, nickel, vanadium, lead and zinc).

Heavy metal concentrations were determined using the U.S. E.P.A. method 3050. Concentrated nitric acid and hydrogen peroxide are used to breakdown organic matter and hydrochloric acid to dissolve the metals. Solution concentrations were analyzed with a Varian atomic absorption spectrophotometer model 1275 with background corrections.

Total nitrogen, phosphorus, potassium, magnesium and calcium were digested in concentrated sulphuric acid and hydrogen peroxide (Thomas et al., 1967). Nitrogen and phosphorus were determined colorimetrically with a Technicon Autoanalyzer. Calcium, magnesium, and potassium were determined by atomic absorption.

Total carbon was determined using a Leco atomic carbon analyzer (Tabatabai, 1970). Moisture content was obtained by mass loss after drying samples at 85 °C to constant mass. pH values were obtained by wetting a dried ground sample to a paste consistency and letting it stand for one hour. The moist sample was then read with a Corning pH meter with a glass electrode.

Organic carbon was determined by heating a dry, ground sample to 450 °C and calculating weight loss (Ball, 1964).

Compositonal analyses were performed on the incoming material from each of the three groups and the mixed material after loading the primary reactor. The individual group samples were obtained by periodically scooping up some of the waste that had passed through the screen. After filling a 10 L pail, the material was chopped to reduce the size and placed into a plastic bag for transportation to the laboratory. These results will be analyzed at a later date to provide input for the decision whether to use a two or three stream collectiion system.

Collecting a representative sample of the material in the cell was considerably more difficult. Sampling probes used for soils, forages, and grains were tried with little or no success. Finally, a 75 mm diameter x 1.5 m tube fitted with a keyhole saw blade and driven with a posthole auger engine produced reasonable core samples.

B. Temperature Monitoring

A temperature probe was constructed using 25 mm diameter PVC piping. A steel tip was fitted to the bottom of a 1.77 m long pipe to allow penetration of the waste and a handle was constructed using a "T" fitting and two 150 mm pieces of pipe. Three 6 mm diameter steel buttons were placed in the pipe wall at 300 mm intervals after a type

T thermocouple junction was soldered to the inside of the buttons. The thermocouple wires were placed inside the pipe and connected in the handle to the wires leading to the data acquisition system (Campbell Scientific Model CR10 with a Model AM416 multiplexer and an IBM PS Model 30 computer).

Although the sampling rate was set at 60 s intervals, only hourly averaged temperatures were printed out for on-site monitoring and stored on a diskette for future analysis.

RESULTS AND DISCUSSION

A. Composition Analysis

In order to determine the number of core samples required to obtain a statistically significant sample of the material in the cell, a composition analysis was performed on nine individual core samples. The corresponding results are found in Tables 2 and 3.

The statistical data clearly indicate significant compositional differences between the nine core samples. This is especially so for the dry matter, cobalt, potassium, calcium, nickel, vanadium, and lead concentrations. For each of these the estimated minimum sample size required at 95% confidence to ensure that the concentration is within 20% of the true mean is 10 or more. Even the nitrogen concentration, which is necessary to determine the C:N ratio, requires a minimum sample size of eight. It is clear from this initial attempt that it is very difficult to obtain a representative sample of a pile of compostable waste.

Although further work is being done to obtain more statistical data, at present three subsamples obtained by mixing nine core samples are analyzed. This will provide sufficient data on the carbon, nitrogen, and moisture content of the waste. It will also provide information on the concentrations of most of the metals.

For the batch represented by the data in Table 2 the C:N ratio of 19 is below the optimum range of 25 to 35 and the moisture content of 61% is within the optimum range of 60 to 65%. In almost all of the ten analyzed batches, the C:N ratio of the collected waste has been between 15 and 20 and the moisture content has varied from 25 to 75%. The variation in the amount and composition of yard waste is the main factor in determining these values.

Although the moisture content is readily adjusted to the optimum range, it is much more difficult to increase the C:N ratio. In a recent batch the C:N ratio was adjusted to 25 by adding 2200 kg of woodchips to the waste of groups A and C. The waste consisted of 870 kg of kitchen waste and 1690 kg of yard waste. Not only would the amount of chips required for a full-scale plant exceed the supply available to the City (even if the unprocessed chips are recycled), but the size of the reactors would have to be larger.

TABLE 2. Compositional analysis of nine core samples.

Core Sample	%N	%P	%K	%Ca	%Mg	% Total Carbon	% Volatile	% Dry Matter	pH
CS-1	1.20	0.260	0.74	2.73	0.85	24.6	48.33	33.32	6.18
CS-2	1.70	0.265	0.90	4.88	1.02	30.8	57.31	34.54	6.30
CS-3	1.85	0.230	0.81	2.60	0.55	37.0	72.56	34.26	6.25
CS-4	1.20	0.215	0.64	6.84	1.28	19.7	65.09	71.08	5.94
CS-5	1.55	0.265	0.83	3.56	1.03	33.4	65.54	38.20	5.98
CS-6	1.65	0.220	0.83	3.53	1.19	33.0	65.93	37.60	5.78
CS-7	1.05	0.230	0.81	3.23	0.95	21.2	41.11	40.22	6.87
CS-8	2.25	0.445	1.25	3.12	0.98	36.5	70.38	26.02	6.10
CS-9	1.70	0.225	0.79	4.09	1.05	34.8	65.58	35.73	6.90
Mean	1.572	0.262	0.844	3.842	0.989	30.111	61.314	38.997	6.26
Variance	0.141	0.005	0.028	1.747	0.043	43.509	109.138	160.876	0.15
Std.Dev.	0.375	0.072	0.168	1.322	0.208	6.596	10.447	12.684	0.39
Coef.of Var.	0.239	0.273	0.199	0.344	0.210	0.219	0.170	0.325	0.06

TABLE 3. Metal content of the nine core samples.

Core Sample	Ni (ppm)	V (ppm)	Pb (ppm)	Zn (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Mn (ppm)
CS-1	15.00	5.25	46.50	115.40	1.40	18.20	18.20	328.00
CS-2	14.50	3.25	20.75	153.00	3.00	20.25	23.50	326.00
CS-3	8.50	0.25	13.00	112.25	3.50	12.75	25.25	202.50
CS-4	8.00	3.00	11.25	123.50	2.00	11.50	21.50	236.50
CS-5	9.75	3.25	12.75	157.75	1.75	25.25	19.75	247.50
CS-6	10.00	5.25	40.00	130.25	3.50	13.50	29.25	232.50
CS-7	9.60	1.80	28.75	150.25	1.60	19.40	14.80	177.50
CS-8	10.25	4.25	15.25	136.00	2.00	17.75	19.25	215.75
CS-9	15.75	2.25	29.00	152.75	2.25	15.25	16.25	244.50
Mean	11.26	3.17	24.14	136.79	2.33	17.09	20.86	245.64
Variance	8.82	2.64	163.36	302.22	0.64	18.74	20.74	2612.42
Std. Dev.	2.97	1.62	12.78	17.38	0.80	4.33	4.55	51.11
Coef.of Var.	0.26	0.51	0.53	0.13	0.34	0.25	0.22	0.21

Use of shredded newspaper is one option being considered, but this would be counter productive in terms of the recycling program. Further work is planned to determine the implications of operating a composting plant at C:N ratios below the optimum level.

B. Temperature Profiles

The temperature data recorded at three levels in the pile and the ambient temperature are routinely plotted to provide temperature histories. For example, Figure 2 shows the plot obtained for batch no. 9 during the first fourteen days in the primary cell. This particular batch was put in the primary cell on May 23, transferred to the secondary cell on June 13, and put in a windrow on July 25. The initial moisture content of the batch was 52% and the C:N ratio was 16.

Since the batch was less than one metre in depth, only the 300 and 600 mm sensor locations were buried. The 900 mm sensor basically recorded the temperatures just above the bed of material with the daily peaks being caused by the sensor's exposure to solar radiation.

The first plot shows that the temperature of the waste moved through the mesophillic and the thermophyllic range to an equilibrium temperature range of 60 to 70 °C in about three days. During the first two days there was no airflow through the pile. The effect of reversing the airflow every six hours is illustrated by the cyclic change in the 300 and 600 mm temperature values during the next five days. During the suction cycle, the airflow is from the top to the bottom of the pile and the 600 mm sensor shows a decreasing temperature as the ambient cools the material above and near the sensor. At the same time, warmer air from above heats the 300 mm sensor until it reaches about 70 °C. At this point the blowing cycle starts and the sensor temperatures change accordingly. This cyclic phenomenon is only observed in batches where the temperature probe appears to be located in a relatively porous section of the bed.

The sudden drop in temperature recorded by the 600 mm sensor on day five was caused by the addition of water to increase the moisture content of the material. It appears that the water only wetted the material near the top of the bed and did not penetrate to the 300 mm level. The effect of water addition is also shown on days 13 and 15. In later batches it was verified that uniformly increasing the moisture content of the pile is difficult without turning or mixing the material.

From day 8 to day 16 the temperatures show a different trend with the 300 mm location consistently exceeding the 600 mm temperature. No explanation is available for this observation except that this period coincided with rainy, cold weather; furthermore, the material depth had decreased through settling and decomposition so that the 600 mm sensor was now nearer the surface of the bed. The near surface position also resulted in keeping the temperature below 50 °C and in causing larger fluctuations during the blowing/suction cycles after day 16.

CONCLUSIONS AND RECOMMENDATIONS

The start-up process of the facility has run into many problems, including frequent breakdowns of the aeration fan. Some of the earlier problems were clearly caused by the weather but others were due to insufficient flexibility in the design of the plant and a lack of expertise in operating a composting facility. As a result, it has taken about six months to achieve the current level of consistency in operating the plant.

Additional design and operating changes are required before the plant will provide the data required for the design of the full-scale system. Changes being considered are

1. the use of preprocessing (grinding and screening) equipment to obtain a more consistent feedstock;

2. the use of individual fans for each cell so that the airflow rate can be controlled and determined; and

3. the addition of a roof to reduce weather effects.

Changes in operating procedures include weighing of the waste streams, rapid analysis and adjustement of C:N ratio and moisture content of the feedstock, and better control of moisture content during composting.

It has also been recommended that the composting program be expanded to include experiments on

1. the use of temperature feedback control of the fans to maintain optimum composting conditions;

2. the effect of turning on the composting rate; and

3. the effect of plastics, including disposable diapers, found in the waste stream on compost quality.

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NIMBY: A POSITIVE INFLUENCE

by

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NIMBY is usually portrayed as a negative and irresponsible force that has prevented us from finding solutions to our environmental crises.

These portrayals sometimes reach near hysterical levels. In an article in Waste Age, for example, Calvin Brunner, a Virginia-based waste industry consultant, said:

> The danger posed by the NIMBYists to our present form of government is apparent. If the people will not take care of the problem, there is a chance that someone else will. This can mean dictatorial powers either given to, or taken by, an individual or a clique ... or a government.[1]

This is an unusually extreme portrayal of the threat posed by NIMBY. The more commonly accepted negative portrayal of the problem of NIMBYs is the following one.

At a meeting of the International Joint Commission in Kingston in 1985, Dr. Don Chant, the head of the Ontario Waste Management Corporation and a founder of the environmental group Pollution Probe, expressed his frustration with those opposing his proposed 300,000 tonne per year hazardous waste incinerator and landfill:

> These people are really saying to the rest of the country that the continuing environmental threat of toxic wastes from thousands of polluting industries is preferable to a treatment plant being located in their own community. "To hell with the environment and people's health," these people are really saying. "My narrow and selfish interests are more important. If 16,000 industries continue to emit hazardous wastes that's fine with me; but don't put a treatment plant to solve this problem in my backyard." The environmental immorality of this tactic fairly boggles the mind.[2]

It is astonishing to brand those with real concerns about the impact of a proposed facility as being "immoral".

NIMBY is a natural, rational reaction to a possible threat to one's community. We all seriously question the possible impacts of a proposed intrusion into our communities. If we all took responsibility for protecting our backyards, we would not be confronted by the major environmental problems now threatening our society.

Certain communities are told they must take these admitted risks because the facility is needed by society at large. Dr. Chant, for example, was recently quoted as saying: "The whole concept of modern society is that individuals and communities may have to suffer in the broader interests of everybody. That's the way we run our affairs."[3]

Do you have any idea what it feels like to be told you will be living in a sacrifice zone? And where do we put these sacrifice zones? Certainly not in the upper class neighbourhoods. And how many sacrifice zones do we tolerate for the greater good? The patchwork of "sacrifice zones" will inevitably spread beyond their demarcations to contaminate all of us. Surely we have learnt the lesson of this fallacy over the past twenty years.

Those who disparagingly portray people refusing to accept waste disposal facilities in their backyards as a major part of the problem have clearly not spent much time working with the so-called NIMBY groups.

These people may begin with no understanding of the problem and are mainly motivated by fear. But they quickly become incredibly well informed. You go into their living rooms or kitchens and find file cabinets full of technical documents that they have gathered from all over the world -- documents that they have painstakingly read and absorbed.

They quickly go beyond simply saying "No" to pointing out why they and no one else should have to incur the risks that such a proposed facility poses. The so-called NIMBYists have joined forces to begin the NIABY movement -- "Not In Anyone's BackYard".

The NIMBYs also quickly come to realize that they have a responsibility to find solutions to the problems of wastes -- not just to say "No". Therefore, their research focusses not just on an assessment of the threats posed by the proposed facility but also on alternative ways to deal with the problem.

How far this experience of the reality of those people called NIMBY is from those who describe them as the problem! The reality is it is those who have to live with the threat who become most aware of the negative impacts and who look for alternatives and real long-term solutions. There is nothing like being under pressure to make you creative. It certainly does not mean these people are selfish.

When we talk of NIMBY we forget what the real problem is: the creation of wastes. Those who negatively use the term NIMBY place the blame for the failure to find solutions to the waste problem one-sidedly and unfairly on the victims of the wastes. As one long-time observer of failed waste disposal siting efforts, Ed Farkas, observed: "Those who blame the NIMBY Syndrome for the failure of these proposals are in fact using NIMBY as a scapegoat to cover the inadequacies of these proposals."[4]

Joel Hirschhorn of the U.S. Congress' Office of Technology Assessment summarized the unfairness of this kind of blame placing:

> There is a solid and continuous base of evidence and experience to support citizen concerns and fears. Public over-reaction and rigid opposition may sometimes interfere with a sensible resolution to a conflict, but that criticism can be levelled against the proponents of siting as much as against its opponents.[5]

The existence of NIMBY has had a very positive influence on our society's search for solutions to waste management problems.

First, it has resulted in a much more serious testing of waste disposal proposals than we ever had before. As a result many proposals have been dropped or substantially revised for sound environmental reasons -- reasons that had not been discovered by the consulting firms of engineers hired by proponents and by the government reviewers.

Many proposals have been dropped by proponents because they realized they could never get them through environmental hearings as a result of information brought up by local citizens' groups. Many of those that have gotten to public hearings have been rejected or revised by hearing boards because of technical flaws in the proposal -- technical flaws pointed out at the hearing by citizens' groups.

Ed Farkas assessed the positive impact of public input at a hearing for a landfill site for Hamilton-Wentworth:

> Twenty years from now the Ontario and Regional governments may be very

> grateful that citizen intervention pointed out the need for these changes. Without these changes, waste management operations at the site may have resulted in severe environmental contamination problems, requiring large expenditures to correct.... Citizen intervention may actually save governmental agencies from themselves, and help them avoid expensive design errors.[6]

The second and more important impact of citizen actions has been that NIMBY has forced us to search for and implement new solutions to our waste crisis -- solutions that would not have been taken seriously without citizen pressure. NIMBY results in the search for better, truly long-term solutions to our environmental problems. Because those who may have to live with the consequences of second best measures for reacting to environmental problems stand up and say "No", new solutions are focussed on.

The opposition of citizens' groups has forced us to raise two fundamental questions that were not being raised before: Is building this disposal facility the best way to deal with the problem? Are we maximizing our efforts to avoid the production of wastes?

Joel Hirschhorn describes the tension between siting waste disposal facilities and reducing wastes:

> Attention paid to siting diverts attention and resources from alternative methods of dealing with the hazardous waste problem. The "costs" of preoccupation with siting are particularly high if alternative approaches confront the problem more directly and offer solutions that are potentially more productive and less expensive. Moreover, if substantive rather than procedural issues are involved, attention to siting diverts attention from the real problem.[7]

Our government agencies are devoting only a small proportion of their resources to waste reduction. The U.S. Congress' Office of Technology Assessment concluded that, even though everyone says waste reduction is at the top of the waste management hierarchy, "over 99 percent of Federal and State environmental spending is devoted to controlling pollution after waste is generated."[8] I am sure that the figures are little different in Canada.

In Ontario, the provincial government has spent almost $100 million in the past ten years in an effort to find a site for a major hazardous waste incinerator and landfill. The provincial government has spent less than three percent of that amount on hazardous waste reduction programmes.[9] Citizens who refuse to accept more and more incinerators and landfills are forcing this situation to change.

Ontario is very proud of its "blue box" curb side recycling programme. From its start in Kitchener in 1986 it has spread rapidly throughout the province. But this spread is a product of citizens' groups insisting that governments show their commitment to waste reduction before being willing to even talk about waste disposal. These same citizens are now pointing out the limited nature of the blue box programme and insisting that more serious waste reduction methods be undertaken.

As a result of public pressure created by the difficulty of siting landfills and incinerators, in April 1989, the Canadian Council of Resource and Environment Ministers agreed "that targets and schedules for waste minimization be established including a fifty percent reduction in waste generation by the year 2000."

Frequently, the public is told that the proponents for new waste disposal sites totally agree with them on the central importance of waste reduction but the landfill or incinerator is needed as a quick interim solution. How ironic that ten years after starting their siting process for a hazardous waste treatment and disposal facility the Ontario Waste Management Corporation is still making that argument. "The most effective step which could be pursued immediately is the provision of off-site treatment and disposal capacity," they say.[10]

Joel Hirschhorn points out the fallacy of this argument:

> One of the most interesting aspects of the tension between siting and waste reduction is the clear historical evidence that siting cannot proceed quickly. Many years can be spent on unsuccessful siting efforts. On the other hand, contrary to popular belief, a significant amount of waste reduction can be implemented quickly because there are a great many methods that do not require substantial capital investment, time, or basic changes in the production process.[11]

We must then recognize the positive influence that NIMBY has been and will continue to be in forcing us to find the best solutions to waste management problems.

NIMBY has become recognized as a powerful force among those trying to site waste management facilities. As a result, the search is on for the way to manage or overcome NIMBY. It includes suggestions such as getting the public involved early in the process, being open with them, intervenor funding, and a multitude of other suggestions.

But most of these appear as little more than public relations efforts to those in communities targeted for waste disposal facilities. The basic flaw in these approaches is that the proponent or consultant forgets that the real problem is the wastes -- not the NIMBYs. The focus is on how to overcome or moderate public opposition -- not on finding the best solution to the waste problem. Connected to this flaw is the reality that the real objective of the proponent is to site an incinerator or landfill. Waste reduction activities are only secondary.

We must remember that the so-called NIMBYs rapidly develop an incredible in depth understanding of the waste problem and, therefore, have real long-term solutions to offer. We must take these people and their proposed solutions seriously and proceed to change our resource allocations to implement the solutions proposed by these people. Until governments sincerely respect the NIMBYs, this will not happen and the current standoffs will continue -- both sides seemingly intransigent.

NIMBY forces us to realize the limitations in our short-term measures and creates the pressure that forces us to seek better solutions. Rather than disparaging those who challenge proposed sitings of waste management facilities, we should thank them for their positive contributions and proceed to change our waste management habits along the lines that they are proposing.

ENDNOTES:

1. "NIMBYists Put Society at Risk", Waste Age, March 1988, p. 70.

2. "The Management of Hazardous Waste in Ontario", June 26, 1985, p. 13.

3. Quoted by Doug Draper in "$80 million later, OWMC proposal to get public test", St. Catharines Standard, February 2, 1990, p. 7.

4. "The NIMBY Syndrome -- Another View" [unpublished, 1982], p.1.

5. Joel S. Hirschhorn and Kirsten U. Oldenburg, "From Facility Siting to Waste Reduction", Forum for Applied Research and Public Policy, Fall 1987, p. 100.

6. "The NIMBY Syndrome -- Another View", p. 5.

7. "From Facility Siting to Waste Reduction", p. 99-100.

8. Serious Reduction of Hazardous Waste: Summary, September 1986, p. 8.

9. Testimony of Dr. David Balsillie, Assistant Deputy Minister, Environment Ontario, at hearings into Ontario Waste Management Corporation, August 13, 1990.

10. OWMC Witness Statement, Panel 08, Facility Capacity and Profiles, September 1989, p. 7.

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THE ROLE OF THE POLICITIAN IN THE SITE SELECTION PROCESS

by

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Introduction

It is the stuff a municipal politician's nightmares are made of; a solid waste site selection process identifies the politican's riding as the primary site for a landfill/energy from waste facility in the region three months before a municipal election. Residents are furious at the the municpal politician for failing to "protect" their area from the intrusion of a waste management facility and an otherwise capable politician loses the election.

The worst part about the situation for the municipal politician is that it is not a nightmare but something which has happened and is happening across the Province of Ontario and, in all likeliehood, across North America.

It is in the context of this nightmare that municipal waste management facility site selection occurs and, all too often, the "nightmare scenario" dominates the way municipal politicians approach the process.

This paper is about the role of the municpal politician in waste facility site selection processes. As is often the case, the role is at the same time extrodinarily difficult to define because of the nature of the environmental assessment process and extrodinarily important to define for the same reason. This paper will attempt to do four things. First, it will examine the process of assessing the impact of projects on the environment and how the difficulties inherent in the assessment make the politician's role very complex. Second, it will attempt to define the role of the municipal politician in the site selection process and outline some of the common pitfalls. Third, it will examine the interaction between the role of the municipal politician and the recently advanced theories on public participation and, finally, it will make some suggestions as to how this difficult issue can be dealt with during the planning process.

It should be noted that the comments which follow focus to a very great extent on the situation in the Province of Ontario. However, aside from specific references to Ontario law, the problem is likely recognizable as a relatively generic one.

Assessing Environmental Impact - Science or Art?
Objective and Rational?

In its basic form, the process of environmental assessment is simple; before a particular project is carried out the law imposes an obligation on the party proposing the project to assess the impact the project is likely to have on the environment. The concept of pro-active environmental assessment was borne, at least in Ontario, out of a desire to evaluate proposed projects in terms of their potential negative impact on the environment rather than simply adopting a punitive approach when damage to the environment occurred. It is now trite but true to say that while the basic concept of assessing environmental impact is simple, its operation is complex and, in some circumstances, downright painful.

To assess the impact of a particular project, or "undertaking" as we say in Ontario, the term "environment" has to be defined. In Ontario it is broadly defined to include both the physical environment (air, land, water, plant and animal life) and the social, economic and cultural conditions that influence the life of man or a community. It is important to keep this definition of the environment in mind because the definition itself has a profound impact on the role the municipal politician has to play in the process of assessment.

The goal of the process is, of course, the protection of the environment by evaluating the impact of various alternative ways of carrying out a particular project and, in the final analysis, to carry out the project in the way which will cause the least negative impact on the environment.

In theory, then, the process works if the participants engage in an objective and rational evaluation of alternative ways of carrying out the undertaking (including the possibility that it need not be carried out at all) on sound planning, technical and legal principles. In other words, the process is to be "a paradigm of rational and logical planning and decision making"[1] and the final proposed undertaking "must be the product of a rational process of evaluating and analyzing a reasonable range of alternatives"[2].

Of course, the "paradigm of rational decision making theory" meets reality when the process takes place in the municipal political forum. Many students of this process, for a while myself included, argue that the fundamental problem in an environmental assessment is that a rational objective process of decision making is given to a political body and the political body is told to make an apolitical decision. It has been stated eloquently in the past that,

> "...the problem is, that the decisions made, from beginning to end, are made by a publicly elected body of politicians, each of which may represent specific geographical interests that conflict directly with the stated goals, purpose and conclusions of the assessment".[3]

I have recently come to the conclusion, however, that the problem is even more complex than that. The problem of a political body being asked to make an apolitical and objective decision is exacerbated by our collective lack of experience in the field of assessing environmental impact. This is where the definition of the environment, as mentioned previously, poses its major difficulty. It is my experience that while the capacity may exist to make an objective and rational decision as to the physical effects a waste management facility may have on the environment, our capacity to evaluate the social, economic and cultural effects of a waste facility is in its infancy. What I am suggesting here is not rocket science. Simply put, environmental impact assessment is a new area of study with few decided cases where fundamental principles are just beginning to be established.

The interaction of these two factors - asking political bodies to make apolitical decisions in an atmosphere where fundamental principles have not been clearly established - has led us to the difficult situation that we are in in Ontario today; the ambiguities inherent in today's environmental assessment process are an opponents best weapon against a site located in their riding or near their home.

It has been stated in the past that the Environmental Assessment Act and the environmental impact assessment process generally appears to limit the ability of elected officials to make decisions which reflect political rather than technical concerns.[4] That is, of course, easier said than done. In an atmosphere where there is a significant motive to discourage sites in one's own backyard, and where technically right answers to difficult questions may not be readily apparent, it becomes difficult to distinguish between a technically correct and a politically expedient decision.

To date, there has been a great deal of critisism in Ontario of elected officials who have made politically expedient decisions which are inappropriate to the environmental assessment process. In some cases, the critisisms are justified. For example, it is not appropriate procedure to arbitrarily delete potential sites from consideration simply because a council majority has a will to do so. It would also not be appropriate to consider only sites which are volunteered in the face of municipal expropriation powers.

However, not all the issues are that clear. The difficulties inherent in a "social impact analysis" are a good case in point. There appears to be some debate in this area of study over whether social impact analysis should be subjective (I feel impacted), objective (You may feel impacted but the examination of other case studies show that you will not really be effected) or both. The now famous decision in the Regional Municipality of Halton's landfill application canvases this difficult debate and does not really put the matter to rest.

As well, the ranking of various factors (hydrogeology, public health, flora and fawna, etc.) to assess impact on the environment is not an exact science and is an issue on which reasonable professionals disagree.

In any event, the purpose of these two examples is simply to reiterate the point that it is all well and good to tell a political body that they must make a rational, objective apolitical decision provided it is evident what consistitutes such a decision. In the absence of well established fundamental principles or guidelines as to how the process is to occur it may not be so easy to distinguish between a debate based on a hidden or not so hidden political agenda and a debate over the merits of an issue which may not have a clear resolution.

The Politician and Public Participation

A very interesting dynamic develops in a circumstance where there is active public participation surrounding a site selection process. The current literature on site selection processes and the "NIMBY" syndrome is now being developed around the concept that increased public participation at the outset of the site selection process and increased public involvement in decision making will help to diffuse "NIMBY" tendencies. This direct association between public groups and staff and consultants embarking upon the process causes a unique dilemma for the politician.

There are, inevitably, times when the issue of who truly represents members of the public, the politician or the community group, arise. This is particularly complex when the respresentativeness of the community group or environmental group maybe suspect. Understandably, the politician, at some point, feels an urge to point out that he or she was elected in a duly democratic fashion and is vested with the responsibility for representing the interests of the community.

Unfortunately, the politician who attempts to make a rational and objective decision with respect to a waste management facility may find him or herself at odds with public groups who want to fight the facility to the bitter end. At that point, the elected official's representation of the whole community comes into direct conflict with representing a particular geographic area and an almost unresolvable situation arises.

Avoiding the Pitfalls - Is There Anything Which Can Be Done?

Thus far, this paper has focused on the fundamental problems which must be resolved in developing an understanding of the role of the elected official in the site selection process. To reiterate, the two problems are as follows:

(i) the environmental impact assessment process envisions a rational and objective approach to decision making but then places the responsibility for the process into the municipal political forum where individual elected officials may have a vested interest in supporting decisions which protect their "backyards" from a waste facility and;

(ii) this situation is exacerbated by the fact that the relatively brief experience in Ontario with siting waste facilities and the lack of a clear track record make determining what is a good decision (a rational and objective one) much more difficult.

Before embarking on a list of suggestions to help more clearly define the role of the elected official in the process, it is useful to discuss, in general terms, what the role should be. In some municipal government situations the role of the politician, in comparison to the role of staff or consultants, is relatively clear. For example, we might ask ourselves what the role of the municipal politician is in approving the construction of a bridge. In this case, the elected officials may involve themselves in the following evaluations;

(i) Unless it is patently obvious, the politician may legitimately be involved in determining whether the bridge goes from point A to B or A to C etc. This may be dependent upon some particular physical factors but there may be some discretion involved in terms of moving the bridge upstream or downstream within an established area.

(ii) The elected officials may become involved in evaluating the aesthetics of the bridge, its external facade, its colour, or the way it blends in to the particular physical structures of the area.

(iii) There may even be some debate as to a choice between particular types of bridges, for example, whether the elected officials wish the area to have a "Cadillac" or "Ford" equivalent in a bridge.

It is also important, however, to describe what it would be inappropriate for the elected officials to exercise discretion with respect to. For example, it would not be expected that the elected officials would;

(i) Exercise some discretion as to the structural integrity of the bridge. They would not, for example, have the discretion to re-arrange some of the main supports for the bridge for aesthetic purposes, or,

(ii) Amend the design work of the engineers which would effect the overall integrity of the bridge.

This is, obviously, an oversimplification, but the point which is being made is that where fundamental principles are established and readily apparent, like the structural integrity principles related to constructing a bridge, elected officials do not have any discretion to exercise. However, where there may or may not be a readily apparent "correct" answer on an issue, for example, the external facade of the bridge, the elected officials are in a position to exercise their discretion.

The point which is being made here is that when fundamental principles are less readily apparent the elected official must choose between what may be competing theories, competing methods of study, or competing ideologies. The key is that this discretion must be exercised in an informed way and with the alternative courses of action clearly set out before the elected officials.

There may be circumstances in waste management facility siting where the elected officials may be provided with a wide spectrum of alternative courses of action from which to choose and there may be other circumstances where the parameters within which the discretion may be exercised are narrow. What is important is that the elected officials be given comprehensive advise and that the parameters within which they must operate on any particular issue are well defined.

Of the two fundamental problems in establishing a clearly defined role for the politician, the first problem, trying to encourage a body of elected officials to make apolitical decisions, will be discussed in greater detail below. The second issue involves an analysis of the inherent problems with environmental assessment and is beyond the scope of this paper. It may take some time in Ontario, and across the country, for the all important fundamental principles to be established in the field of environmental assessment. The case law is scant and we are all on the infamous learning curve. In my opinion, as the fundamental principles become more readily apparent, the role of the elected official and the parameters within which discretion may be exercised will, inevitably, become more clearly defined.

While assessing environmental impact should be an easier process once a track record and guidelines have been established, there is really no time for anyone to sit idly by and wait for the rules of the game to become clearer. There are a number of constructive actions which can be taken to enhance the political decision making process and the role of the politician in the circumstances which exist today. These constructive actions are outlined below.

(i) Environmental Assessment Education

It is my experience that elected officials very often are well informed in terms of waste management options. These individuals are often very knowledgeable about such things as composting, recycling, recycling markets, reduction, energy from waste, and refuse derived fuel systems. Very often, they have participated extensively in conferences and have travelled to various waste facility sites across the province. In contrast, however, elected officials very often have not had a sound education in the field of environmental assessment. This is really not surprising considering that the process is relatively new and extremely complex.

Nonetheless, a solid grounding in environmental assessment is a fundamental requirement on the part of decision makers involved in waste management decisions. It is not even acceptable that the involved elected officials have a passing knowledge of environmental assessment; they must have a very solid grasp on the requirements for the successful completion of an environmental assessment process. Therefore, the first and most important thing to do with a group of elected officials who will be involved in assessing the impact of a particular project on the environment is to educate them about the environmental assessment process. The education must take place from a legal, planning and technical perspective and must clearly set out what the role of the elected official is in the overall provincial process.

It is also very important that the public and members of the media be educated as to the environmental assessment process. This is important because these are the two groups of individuals which often give a conscientious politician trying to act in accordance with his or her obligations the hardest time. If everyone who participates in the process has a better understanding of the requirements which face the municipal politician, then it should be easier for him to fulfill the objective/rational policy decision making role.

(ii) Staff and Consultant Credibility

I have an engineer friend who tells a story of a presentation which resulted from months of very hard work on a multi-million dollar project. The project was a controversial one and at the relevant public meetings on the project maps showing different peoples residences were on display. The professionals involved were prominent in their field and extremely well briefed on their subject. However, during the course of the public meeting, the proverbial "little old lady" noticed that her house had been placed on the wrong side of the road on one of the large scale maps. Months of work at building credibility with the public was destroyed by one simple comment from that little old lady. There is nothing which will defeat a politicians attempt to act in a rational, objective way in the middle of a controversy more than an inability on the part of staff and consultants to maintain their credibility with the public. If we are to make the argument that there are correct and incorrect decisions in the course of assessing the environmental impact, staff and consultants must be able to defend in a professional and credible way the decisions which are made.

Because the credibility of staff and consultants is so critical in this area, it is important that both staff and consultants be chosen not only for their technical ability but for their communication skills and, in particular, their communication skills both at Council and with members of the public. It is not enough in this game to be a good technician, one must also be a good communicator.

(iii) Ambiguities

If there are ambiguities and controversies surrounding particular decisions, for example, whether social impact should be a subjective or objective analysis, the ambiguities should clearly be set forth for the elected official. The politician is in a far better position when he or she understands that while in some circumstances the "right answer" may be readily apparent in other circumstances it is not. This should develop into an understanding of areas where discretion may be exercised and areas where it can not.

(iv) The Parameters of Decision Making

It is incumbent upon staff and consultants, when issues are put to elected officials to clearly define the parameters within which the elected officials can exercise their discretion. If there is really only one correct alternative then staff should make a forceful recommendation that that is the only correct alternative. However, if Council has a choice from among five different alternatives those alternatives should be clearly put to Council with a recommendation from the staff and professionals involved. It is important for staff and consultants to build credibility so that when they say to an elected official "on this issue there is really only one correct choice" the elected official believes them. That can only develop if staff is open and honest about how much discretion can be exercised by an elected official on the particular matter before them.

(v) Record the Exercise of Discretion

It is absolutely critical in the environmental assessment process that where elected officials have been asked to exercise their discretion because the "right answer" may not be readily apparent, that the exercise of that discretion is recorded in a detailed fashion. The environmental assessment process seems to recognize that there is some ambiguity and that there may be some areas in which Council can appropriately exercise discretion provided that it can demonstrate the decision making process which occurred.

Conclusion

There is no easy way to define the role of the politician in the waste facility site selection process. The fundamental problem is that the boundaries of discretion which elected officials can exercise in this process are not well defined. What is important to recognize is that each time a body of elected officials is asked to make a decision they must be informed as to what type of discretion they can exercise and still meet the requirements of the environmental assessment process.

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Communication and Education as an Aid to Reduction and Recycling of Hazardous Wastes in British Columbia - A Partnership Approach

Patricia Sloan, BC Hazardous Waste Management Corporation

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Texte non reçu au moment de mettre sous presse

COMMUNICATION AND EDUCATION AS AN AID TO REDUCTION AND RECYCLING OF HAZARDOUS WASTES IN BC - A PARTNERSHIP APPROACH

To be presented in St. John's, Newfoundland by a representative of the BC Hazardous Waste Management Corporation

With the enactment and enforcement of government regulations in British Columbia, industrial-scale hazardous waste can be identified and accounted for. Hazardous wastes generated by households and small businesses remain a serious public health and environmental quality problem, for several reasons:

- Lack of information and understanding of the nature of hazardous wastes,
- Limited options for reduction and recycling,
- Lack of cost effective access to appropriate collection and disposal facilities, due to an inefficiently functioning marketplace, and
- the negative impact of regulations designed for industrial scale wastes, which in some cases, create a propensity to avoid existing safe reduction and disposal options.

The newly created BC Hazardous Waste Management Corporation has a unique mandate which focuses on reduction of hazardous wastes, and a target base which includes households, small businesses, and government agencies as well as industries in the province. Information and education is a primary activity of the first year of operation, and all BC government agencies are being recruited to carry the hazardous waste reduction message to their client groups.

The presentation describes a wide range of government agency activity coordinated by the Corporation, ranging from environmentally safe government purchasing policies, to demonstration of reduction and safe handling of government generated hazardous wastes, to reconsideration of special waste regulation in the Province. The plan is to use this new and on-going communication and education strategy to build into partnerships with households, small businesses, industries and all levels of government, leading to the development of an active business sector in hazardous waste reduction and management opportunities.

Nixing the NIMBY by talking to the people

by

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INTRODUCTION

Acid rain, CFC's, PCB's, greenhouse effect, recycling, composting, sanitary landfills, incineration, and NIMBY's. As a novice in the environment business, I've had to learn the meaning of these words - all in the last year. And as a newcomer to the field, I've had the opportunity to observe how the public reacts to all of the technical jargon we employ. So let me start by saying that the field of waste management is not faced with a technical problem, but a human problem.

A major change in the management of solid waste is under way in New Brunswick. The province has been divided into a number of regions, each of which will develop a plan for the management of its own solid waste. These plans will cover the closure of old dumps already filled to overflowing and the establishment of new regional facilities to be shared by the communities within that region. The planning process is directed by local solid waste committees, which include representatives from the municipalities, technical experts and members of the public. Their task, with the support of the New Brunswick Department of the Environment, is to oversee the transition from the old system of local dumps to the new one of shared facilities.

In my region, there are presently 21 dumps, none of which conforms with environmental standards. Each and every site must be closed within a couple of years. My role as executive director is to execute the wishes of my Board of Directors. As such, I administer the project and I'm responsible for all aspects of public information.

The detailed planning process will ensure a smooth and efficient transition from the conceptual stage to implementation. It has four components: public information and consultation, evaluation of options, identification of a potential site, and Environmental Impact Assessment.

During the next few minutes, I will give you an overview of the public information and consultation process, including the role of advertising in this era of "Not In My Backyard".

PUBLIC INFORMATION AND CONSULTATION

Experience across New Brunswick and elsewhere has clearly shown that establishing positive relations with the public is a crucial first step toward the long-term success of any attempt to develop a new waste management plan. Public information and consultation programs must be the secure foundation on which the planning exercise is built.

Planning for new solid waste disposal facilities can be a controversial and difficult process. The reasons are varied and some are tied to local issues. However, similar themes emerge in case after case. Public concern about environmental issues has grown rapidly over the last decade. Media coverage of environmental disasters is a familiar story to anyone who watches network television news.

Generally speaking, early solid waste disposal facilities were not well planned, well sited or well operated. As a result, public scepticism and, in some cases, outright fear of new waste management proposals are understandable. Given these realities, it is clear that sufficient time must be provided at the outset for productive public involvement and a full discussion of the issues.

The first objective should be to build public awareness of existing garbage disposal problems in the area , and then to set out in detail the options that are available for solving them. Second, the financial impact on local taxpayers must be clearly presented. And third, individual citizens must be recruited and actively encouraged to get involved. A significant challenge is to direct the energies of concerned residents away from simply condemning past mistakes, and toward the search for a better way of managing their current and future waste.

While an informed perspective can be enhanced by looking at the environmental dangers arising from past mistakes, the goal should be to learn the lessons from those mistakes and then get on with the job of devising and putting into place a better management system.

I want to caution you that an informed public does not always guarantee that there will be no opposition to new proposals. But the evidence is that without any public information program at all, the task will be much more difficult. Remember Abraham Lincoln's words: "With public opinion against it, nothing can succeed. With public opinion on its side, nothing can fail."

Public awareness and involvement will not always guarantee that there will be no opposition to new waste management proposals. But there is evidence to support the opposite premise... that without effective public information and participation, attempts to develop new waste management facilities in regions throughout North America may be extremely difficult.

ADVERTISING IS COMMUNICATIONS

Historians believe that the outdoor signs carved in clay, wood or stone and used by ancient Greek and Roman merchants were the first form of advertising. The signs weren't meant to be persuasive; rather, they were simple tools of communication. And since most of the population was unable to read, the signs often bore symbols of the goods the merchants had for sale.

How we can apply the concepts of advertising and public relations seems quite apparent. With the lingering obsessions of our newborn environmentalist public, we need to be able to confront the realities of waste management to them.

The waste management message must be put before the public simply and effectively. One of the best ways of doing it is through advertising. That is why an increasing number of regions faced with the need to build new facilities have begun to use paid advertising as a primary channel of communication. It is the only medium they can control with respect to content, timing and frequency of delivery. And it is the only one which enables them to select their own battleground. If you think that the media is going to do the job of educating the public on the merits of incineration, for example, or on the logic behind the concept of tipping fees, you are badly mistaken.

As a rule, we use advertising and public relations to deliver "good news" about our initiatives. While advertising can get the message out, good public relations can be used to manage more effectively the relationship between the committee doing the work and the public at large.

If you think part of my message here is to pitch for advertising agencies and public relations firms, you're right. Hiring their expertise is just as valid an investment as paying for the services of the consulting engineers. But advertising is a tool that should not be used solely in an emergency situation or as a last resort, they must be planks in the ground floor of your master plan. The risks are simply too high and the results so unpredictable.

However, if public relations professionals are given an opportunity to do their work for you - tasks ranging from press agentry to special events management to speech writing - you may never have to call on them to provide crisis communications. They are employed to generate good news from basically low-news-demand organizations, and the activities they are concerned with reflect that fact. In order to plan and execute your overall communications program, the p.r. professional will have to analyze the relationship between your organization and the public that it serves, evaluate their attitudes toward your group, assess your policies and actions, and only then plan and execute the necessary public relations activities.

The overall purpose, of course, is to influence public opinion in your favour. It might take the form of rallying public support behind you at one time, of encouraging public understanding or neutrality, at another, or simply being ready to respond to public concern and inquiries. Most importantly, whatever the message is, it should not insult the public's intelligence.

In my region of New Brunswick, we believe that we have been so successful at keeping the people informed, that the general feeling is that few will object to having the new waste disposal facility built in their area. The NIMBY factor, we hope and believe, has been overcome.

RESEARCH: INPUTS TO THE PLANNING PROCESS

The theme for the message I've been giving you could be: "Information out, information in and information in, information out". The opinion of your public is so vitally important to the success of your initiative that ignoring or failing to inform yourself about their opinions could be fatal!. If the general population does not agree on the disposal method you've selected, do you think they will accept the site you've chosen for the facility? That is why you - the decision-makers - need research.

Research is the systematic gathering and analysis of data that will be important in developing your public consultation strategies. It plays a key role in identifying public needs, perceptions and habits. The first step inthe research process is to define the problem and set research objectives. The statement should contain three basic elements:

1. The information to be gathered must be measurable.
2. It must be relevant to the problem
3. The various pieces of information must be related.

Methods used to collect data include observation, experimentation and surveys. Observation is used when researchers actually monitor the actions of the persons being studied. It may take the form of a traffic count, or a television audience count by means of an instrument hooked to television sets, or a personal study of the ways in which consumers react to products displayed in their supermarkets.

The experimental method is designed to measure actual cause-and-effect relationships. An experiment is a scientific investigation in which a researcher alters the stimulus received by a test group or groups and compares the results with those of a group that did not receive the altered stimulus.

The survey is the most common way to gather research data. By asking questions about current environmental issues or behaviours, the researcher hopes to obtain information on attitudes, opinions and motivations. Most commonly, surveys are done be telephone, by mail and through personal interviews.

COMPARISON OF DATA COLLECTION METHODS

	Personal	**Phone**	**Mail**
Data collection costs	High	Medium	Low
Data collection time required	Medium	Low	High
Sample size for a given budget	Small	Medium	Large
Data quantity per respondent	High	Medium	Low
Reaches widely dispersed sample	No	Maybe	Yes
Reaches special locations	Yes	Maybe	No
Interaction with respondents	Yes	Yes	No
Degree of interviewer bias	High	Medium	None
Severity of non-response bias	Low	Low	High
Presentation of visual stimuli	Yes	No	Maybe
Field worker training required	Yes	Yes	No

(Source: Bovée & Arens, Contemporary Advertising, 1989.)

In our area, we've had in the past year two random telephone surveys and two focus groups. The results have permitted us to continually monitor the attitudes of our residents. For instance, we've been able to monitor the level of public knowledge concerning:

- Environmental issues in general.
- How much they know about he options available for waste disposal in our area.
- And the level of awareness and perception of our committee has with the public.

All of this information is pertinent to the continuous process of information out, information in and information in, information out..

During last spring's 14 public meetings held in the region over a four-week period, three major issues surfaced:

- How our future initiatives would deal with hazardous household waste?
- How we would deal with illegal dumping?
- What would be the cost of the proposed initiatives to the taxpayers?

To verify that these were also the primary concerns of the general public, we commissioned an independent marketing firm to organize two focus groups of twelve members each. The first group was composed entirely of urban residents, while the second comprised rural residents. The results of our public meetings were confirmed. In fact, much more insight was acquired from the focus groups than from the public meetings. Public consultation is vital to the credibility of our siting process, and we will continue using research to measure public attitudes.

We are now in the third year of our effort to establish a regional facility for southeastern New Brunswick. We cannot lose any precious time because we were unable to understand public attitudes and perceptions. Our 21 existing dump sites do not conform to environmental standards, they are in fact 21 time bombs. It is a race against time.

A few last words on research. Effective surveys have three important attributes: focus, brevity and simplicity. They focus directly on the issue being surveyed; they are as brief as possible while still conveying the intended meaning; they are expressed as clearly and simply as possible.

Information that has been previously collected and published, usually by another organization for another purpose, is referred to as secondary data. Obviously, utilizing secondary data is less costly and less time consuming, but there are potential problems.

- The information might be obsolete.
- It might not be relevant to the problem at hand.
- It might be invalid or unreliable, depending on the manner in which it was collected.
- The volume of information available for assessment might be overpowering relative to the size of the problem being studied.

Reliability does not imply validity, but validity will imply reliability.

CONCLUSION

Our region is not the first or the only one to appreciate that public information and consultation is vitally important to siting a new waste management facility. Although the public comes in various shades of green, it can no longer be ignored.

Permit me to quote from the *Ontario Department of the Environment, Public Involvement Guidebook*:

"A good community relations program:

- Will help you to know what your community thinks about various issues, often before these issues become high profile problems.
- Will provide you with an opportunity to advise the community about what you are doing.
- Will encourage your community to contribute ideas for solving environmental problems.
- Will build trust and cooperation as people feel confident that they are being heard.
- Will make your job easier and more enjoyable and, most important, effective."

A community relations program will not eliminate conflict or magically achieve consensus on all issues, but it will provide a climate that allows for increased understanding and cooperation so that acceptable solutions can be found. Good community relations will always result in a better working relationship with the community as a whole.

Most planning for new waste disposal facilities now include a public consultation component in the forefront of the process. Most programs are now designed to build confidence in and credibility for the entire process, from conception through planning and design, by ensuring that it is open to scrutiny and accessible to input at each stage.

I was also surprised to see that most new siting of waste disposal facilities do include a public information and consultation component at the forefront of their planning process. Making each aspect of their work sensitive to the public interest, and allowing for public input into how and where solid waste management, including disposal, takes place. Most programs are now designed to build confidence in, and credibility for, the entire planning and design process, by ensuring that it is open to scrutiny and accessible to input during each step of the process.

One last quote from a recent marketing journal: "Today the environment is a primary concern. You can't do business without thinking about your impact on the environment. No business is exempt. It's no longer just an issue for the smokestack industry."

Let us not forget that dealing effectively with the current environmental crises is not constrained by technical problems, but rather by human problems.

Litter Reduction Project at the 1988 and 1989 St. John's Annual Regatta

A Case Study

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INTRODUCTION

A. Background

Littering is a major problem associated with large scale public gatherings in this Province and in view of this, the Department of Environment and Lands decided to establish a program to address this problem. The largest event held in the Province is the St. John's Regatta and it was felt that this would be a good starting point to initiate such a program.

Following the 1987 Regatta, the Minister's Office issued a Press Release commenting on the excessive amount of littering associated with this annual event. In the statement, several references were made including the amount of litter and the associated clean-up costs involved.

As a result of this Press Release, the Department was approached by the St. John's Regatta Committee and the City of St. John's Tourism, Parks and Recreation Department to help co-ordinate a litter reduction strategy for this annual event. This Department accepted the invitation and a two-year pilot project was initiated.

B. Purpose

The two-year pilot project for the Department was deemed important as if proven successful at this event, then the ideas could be applied elsewhere. Simply, the purpose was to establish criteria, to monitor and identify positive and negative aspects in planning, execution and follow-up which will or can be applied to future such gatherings. The Department also anticipated the project would be beneficial for increasing public awareness to the problem, be somewhat educational, and lead to a reduction in clean-up costs for such events.

1988 REGATTA

A. Preparations

A Planning Committee consisting of the Regatta Committee Members, City and Departmental staff was established. Through a series of committee meetings, project criteria was established. The criteria consisted of such things as:

a) site planning for a large number of litter containers
b) obtain the co-operation of the concession operations

c) acquire assistance from the media to promote the project
d) assign responsibilities to each Committee group.

During the planning meetings, several problems associated with the site were noted. These included steep slopes in certain areas (difficult for container placement), excessive pedestrian traffic at certain locations at peak periods of the day. The action plan, as such, was developed and its outcome was unknown. Monitoring by Department staff and City officials was carried out throughout the days event.

The initial items to be completed were to obtain an adequate supply of litter containers and to arrange for their placement in order to achieve optimum use of them. This was completed and it was decided to use three types of litter containers; 205 litre drums, larger rectangular containers and City Sanitary Compaction trucks. The trucks would be used to compact garbage from 205 litre drums and to accept garbage from smaller containers and concession operators.

In addition to the site review and planning strategy, the Department recognized that the assistance of the concession operators was required. Subsequently, the Department prepared over 200 information kits for the operators. The kits were presented when the operators obtained their site permit from the Regatta Committee. The kits contained information such as guidelines for concession operators, a map showing large trash receptacle sites, anti-litter signs and Departmental Litter bags and buttons. During the presentation of the kits by Departmental staff, concession operators were informed of the program and their assistance was requested to help make the program a success. Primarily, the operators were requested to post the enclosed signs and to remind their patrons to use the litter containers provided. Most operators were optimistic about the program and agreed to help on Regatta Day.

In addition, the Department initiated a Media-Advertising Campaign. These ads were broadcast on Radio and Television to seek the public's co-operation in reducing litter at the event. The majority of this advertising was aired in the few days preceding the event. In addition, the Minister held a Press Conference to announce the program. Coverage of this event was reported on local radio and television as well as the local newspaper. The various media in the City supported the project and agreed to assist however possible.

Voluntary sponsorship by local companies and the Department of Environment provided prizes for litter conscious patrons to the

Regatta (eg. 6-pack of soft drinks, small stuffed animals, T-shirts for kids and anti-litter badges).

B. Regatta Day 1988

All the preparations had been made and the planning committee were ready. The site was well laid out with trash receptacles and the concession operators hoped for a good day.

A Departmental booth was on the Regatta site to provide information and to award prizes to litter-conscious individuals and was staffed throughout the day. Department staff on duty maintained a presence and a very large number of the public dropped by and praised our efforts. Questions of all types were posed to the various staff members and verbal response and printed information were provided. In addition, free buttons, litter bags and candy for children were available. A great deal of public exposure to litter reduction was achieved by the Department's presence on the site.

Staff were also assigned the tasks of monitoring several aspects of the event. These include:

a) pedestrian traffic and noting any areas of congestion and ways to alleviate such problems as this contributed to the litter problem.

b) examples of properly maintained concessions as well as poorly maintained ones were noted.

c) litter-conscious public were observed by staff members. Members of the public spotted using a litter container were awarded a prize to be picked up at the booth. Prize recepients' names were aired by radio media at the Regatta site.

Throughout the day, some of the traditional areas of congestion were noted. Staff members notes and recommendations were recorded and discussed in future meetings. In the assessment of these areas and sites, solutions to identify problems were discussed and new approaches considered for future events.

C. Outcome

The first major outcome of the anti-litter program was noted the morning following the Regatta. In previous years, the grassed area of the site was almost entirely covered in litter of all types. After this event, the usual mess was non-existent as clean-up of the site was achieved for the first time in the evening of the event and with much less volume of waste that required clean-up. Members of the Planning Committee were pleased with the results obtained, both the reduced volumes of waste and the cost savings realized by reduced overtime payments to City clean-up crews.

At a follow-up Planning Committee meeting, the following issues were addressed:

a) the entire project and Departmental booth were very well received by the public and concession operators. The Regatta Committee commended the Department for its efforts.

b) there was a vast amount of litter reduction. This was obvious on the day after and the project saved a portion of the usual clean-up costs associated with this event. In the past, the clean-up, conducted by the City of St. John's sometimes took two days to complete. This labour intensive effort was not required in the 1988 event.

c) congested area sites were reviewed with an outlook to improve booth and waste container layout for coming years events. In addition, poorly operated concessions would be addressed.

d) decisions were reached for planning of the next year's event, the structure of the Committee, timing and co-ordination of staff equipment plus media promotions and announcements. It became clear that early planning and budgeting enabled smooth running of the anti-litter project (as well, gave broader time frame to sustain public consciousness over litter and littering concerns).

1989 REGATTA

A. Preparations

The Interagency Committee focused on the successes of the 1988 event and a similar plan was developed for the 1989 event. Additional litter containers were obtained and their overall placement on site was given minor adjustment to provide for maximum benefit to concessionaires. An additional effort was made with media advertising; this increased effort to increase and sustain public awareness in the weeks and months preceding the annual event.

One minor setback occurred. The Department distributed the information kits as done in 1988, but there was a lower turn out of concession operators at the pre-Regatta briefings. Some operators did obtain the site permits later along with the Department information kit from the Regatta Committee. The Department therefore could not address each group as in the previous year and could not re-enforce the litter reduction effort planned for the event. In addition, it was noted that some of the operators were not as enthusiastic as they were in 1988.

B. Regatta Day 1989

The Departmental booth was operated again and was quite well received by the general public. In addition, an adjoining booth sponsored by a re-cycling Company was very well received based on the volume of visitors to the booth. Both booths were busy throughout the day.

Again, Departmental staff were given monitoring assignments similar to those in 1988 and rewarded litter-conscious public and children with small prizes. Public announcements were made of prize winners to re-enforce litter consciousness of Regatta patrons and concessionaires. Areas where adjustments had been made were noted and it was apparent that in these areas waste handling was improved. The litter containers were well utilized and in some places more space was made for pedestrian traffic in areas where bottlenecks of pedestrians created litter pick-up impossible in past events.

During the course of the day, the traditionally bottlenecked areas were constantly monitored. These locations required specific plans if any major improvements were to take place. The area near the start/finish line represented the most serious area of congestion. The layout plan for booth placement and frequency of waste pick-up from this area had positive results with litter clean-ups. The area is still a problem, however, less of a problem than in previous years.

Overall, concession operations were reasonably maintained. However, there were a number of poorly operated sites and these certainly added to the mess. "Nevada" type ticket sales contribute significantly to the problem. Another problem noted was open areas where people would sit to eat. Steep terrain limited clean-up crews in clean-up efforts throughout the day. Placement of litter barrels in these areas was not reasonably possible and the distance to litter barrels for deposition of food wastes was attributed to the volumes of discarded food waste on grassed slopes of the site.

C. Outcome

The anti-litter program was a general success. The amount of litter was reduced and there were some cost savings. Increasing numbers of people and concessions and corresponding volumes of waste were better controlled with overall reductions in litter. Public consciousness and will to control littering were realized. Other mass assemblies held throughout the Province could benefit with more pre-event planning and co-operative effort in addressing the litter issue and the benefits that may be realized in future such events.

SUMMARY

Waste control and management are major aspects of mass assembly functions. Pre-planning and co-ordination involving concessioning and media information services to the public go a long way to litter control and costs of such events.

a) Site Review

Layout of the site and spacing of concessions along with placement of litter containers and waste collection vehicles and/or bulk waste units are integral aspects of waste management and control. Public concessionaire co-operation is also essential in pre-event during and post event litter control.

b) Concession Operation

The planning group should establish some anti-litter guidelines. Food operators should be urged to use acceptable containers and must have litter barrels. Ticket sellers must have litter containers and also a "rake-up" person assigned. A standard sized booth should be considered.

Monitoring during the day for compliance to ground rules is necessary. Those who do not comply should be approached and told to commence clean-up. A clean-up deposit if considered. Merit awards to concessionaires or prizes or clean booth setting go a long way to promoting litter reduction awareness.

c) General Public

Depending on your location and size of your event, there are a number of things that can be done. Local advertisers could be approached to mention your litter reduction program in their ads. You could put notices in stores, offices, etc., advertising your event and the anti-litter program. A flyer distributed to your households is another consideration.

Advertising that is done to promote the event should be used to remind those attending the event that their effort counts in overall litter and waste control.

Each person has a role to play in litter control. With a conscious effort, a litter-free event may be realized. The benefits that are realized are in part cost savings to event sponsors but more importantly are reflected in future event attendance and success. major benefits are the educational component to school age children and the general public controlling litter controlling pollution is everyone's responsibility.

Household Hazardous Waste

Tracy Patterson, Ontario Waste Management Corporation
Toronto, Ontario

Paper unavailable at time of printing
Texte non reçu au moment de mettre sous presse

LEACHABILITY OF BOTTOM ASH FROM A MUNICIPAL WASTE INCINERATOR

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May, 1990

INTRODUCTION

While the incineration of municipal solid waste (MSW) results in a waste mass reduction of approximately 70%, the amount of residue remaining to be disposed of after incineration is substantial. The 48 MSW incinerators operating in the Federal Republic of Germany (FRG) currently produce about 2.8 million tonnes of incineration residues annually. This figure is expected to increase to 5 to 6 million tonnes within the next few years (Hiersche and Wörner, 1989).

MSW incineration can produce three main types of solid residues: (1) fly ash, which is the fine dust entrained in the flue gas, (2) flue gas cleaning salts and sludges, and (3) bottom ash, which is the residue dumped off the grate after the waste has passed through the combustion chamber. Usually, boiler ash, which is similar in composition to coarse fly ash and makes up about 1% of the total mass of residue, is combined with the bottom ash. In the FRG, the three main waste streams are disposed of separately. While it is generally accepted that fly ash contains hazardous levels of heavy metals, and flue gas treatment sludges are physically unstable, bottom ash, which accounts for about 90% of the total mass of incineration residues, can be utilized in road construction.

Guidelines for utilization of bottom ash in road construction are provided in several publications (LAGA Merkblatt, 1986 and FgSV Merkblatt, 1986). However, although these recommendations include very simple leaching tests, investigation of the suitability of bottom ash for replacement of aggregate has centred around the required structural and mechanical characteristics. There is a scarcity of information about the environmental acceptability of such a practice. Consequently, the Laboratory for Isotope Technology (LIT), as part of a larger effort in cooperation with the University of Karlsruhe, has undertaken to examine the characteristics of bottom ash which will affect its short and long-term behaviour in the environment, particularly in a utilization scenario.

The work described in this document concerns the detailed investigation of bottom ash from the Göppingen regional energy-from-waste facility (Landkreis Göppingen, 1985). This facility incinerates approximately 200 000 t/a of municipal solid waste, which has been homogenized and preheated with a maximum of 10% sewage sludge. The waste passes through the incinerator on a "System Düsseldorf" roller grate, air-flow is counter current, and the incineration temperature is approximately 850°C. After quenching, the bottom ash is dressed by sieving and magnetic separation of metals. Particles smaller than 32 mm are retained for utilization, and normally stored for several months before use. Prior to September, 1989, the boiler ash was combined with the bottom ash, but modifications were made in order to dispose of the boiler ash with the compositionally more similar fly ash. This study involved investigation of bottom ash before and after these modifications.

OBJECTIVES

The objectives of the work reported in this paper were:

1) To determine the temporal and spatial variability of typical municipal waste incinerator bottom ash, with respect to composition and

leachability,

2) To examine the effect of conditioning the bottom ash by outdoor storage prior to utilization on its leachability, and
3) To examine the effect of separating the boiler ash from the true bottom ash on the leachability of the bottom ash.

APPROACH

Bottom Ash Collection

Since November, 1988, grab samples of dressed Göppingen bottom ash have been collected and tested once or twice a month. These data were provided to the LIT by the Göppingen regional authority, and were used to study variations in the bottom ash composition and leachability as a function of time.

Dressed bottom ash containing boiler ash was collected by the LIT from the Göppingen facility in January and June of 1989 for more detailed testing. The ash collected in January was tested at the time of collection, and after 23 weeks of outdoor storage. The ash collected in June was tested at the time of collection, and after 15 weeks of outdoor storage.

One sample of dressed bottom ash without boiler ash was collected in October and two further samples were collected in November, 1989. These samples were tested before outdoor storage.

For each sampling time, samples of approximately 1 tonne were separated from the main pile of bottom ash, at the outlet from the bottom ash preparation plant, using a bulldozer. These heaps were homogenized and divided into subsamples of a few kilograms for chemical analysis and leachability testing at the LIT, and subsamples of several hundred kilograms for structural characterization at the University of Karlsruhe.

At the time of the June sampling, four small samples were also taken from different points in the main bottom ash heap, in order to examine the homogeneity of bottom ash generated at a particular time.

Bottom Ash Testing

On a routine basis, the bottom ash samples from the Göppingen facility are subjected only to total analysis for heavy metals and the German standard leachability test (DIN 38414, 1989).

Table 1: Test Methods Applied to Bottom Ashes from Municipal Solid Waste Incineration

Chemical Analysis of Solids
Loss on Ignition
Moisture Content

Equilibrium Extraction
Sequential Chemical Extraction
Acid Neutralization Capacity

German Standard Leachability Test
Swiss Leachate Test

The more extensive testing performed on the samples collected by the LIT included the tests listed in Table 1. Leachability of the bottom ash was examined using components of a set of test methods assembled at Environment Canada's Wastewater Technology Centre for the testing of solidified wastes (Stegemann and Cote, 1990). Bottom ash is a highly alkaline alumino-silicate based material which is similar in many ways to cement-based solidified wastes; the major difference is its physical structure, which is particulate rather than monolithic. Heavy metal contaminants in a solidified waste are usually immobilized chemically by the highly alkaline environment, and also physically trapped in a monolithic matrix of low hydraulic conductivity. In bottom ashes, however, a relatively high hydraulic conductivity can potentially result in rapid advective leaching of soluble contaminants. Contaminants must be chemically immobilized in order for the material to be environmentally acceptable for utilization. Therefore, the test methods applied to the bottom ashes in this study focused on chemical containment of contaminants.

The chemical composition of the solids, loss on ignition and moisture content of the sample were measured to provide basic information about the sample. The total concentrations of heavy metal contaminants and anions were used to select contaminants of interest in the leaching tests. The carbon content and loss on ignition (3 hours at 550°C) are indicators of the degree of combustion.

An equilibrium extraction, a sequential chemical extraction, and measurement of acid neutralization capacity were conducted on dried finely ground sample (<0.2mm), to ensure that chemical rather than physical factors determined the concentrations measured in the leachates.

In the equilibrium extraction, the finely ground sample was mixed with distilled water at a low liquid-to-solid ratio for a period of 7 days. Under these conditions, the bottom ash establishes the chemical environment in the leachate and steady-state concentrations in the leachate can be measured. The contaminant concentrations measured in this test represent the concentrations in an undiluted leachate at time zero, and are indicative of the solubility of the contaminants in bottom ash in the short term.

In a disposal or utilization scenario, the chemical environment initially provided by the bottom ash will be gradually modified by the chemical characteristics of the surrounding environment. With time, the alkalinity of the bottom ash will be neutralized by infiltrating acidic rain or groundwater, and oxidation of residual carbon to carbonic acid. Thus, over the long term, the solubility of heavy metal contaminants will increase. To estimate the total amount of contaminant available for leaching over an infinite time, with an infinite supply of leachant, the bottom ash samples were subjected to a sequential chemical extraction (Tessier, et al., 1979).

In the sequential chemical extraction, a sample of crushed waste was contacted with a series of five chemical leachants, each of which was more aggressive than the previous one (see Table 2). Each of the successive extractions may be interpreted as a "worst case scenario". It has been suggested that the amount contained in fractions A and B represents a conservative estimate of the fraction of the contaminant which is ultimately available for leaching in a segregated landfill, while the amount contained in fractions C might be available under the more severe reducing conditions of codisposal with municipal solid waste, and fractions D and E remain unavailable for leaching (Kramer, et al., 1988).

This test has also been used in the past to examine contaminant partitioning in municipal solid waste incinerator fly ashes (Sawell, et al., 1988).

Table 2: Sequential Chemical Extraction Test

Fraction	Leachant	Release subject to changes in
A	0.25 M CaCl 0.75 M LiCl 60% CH_3OH	Ionic Composition
B	1 M CH_3COONa in CH_3COOH (pH=5)	pH
C	1 M $NH_2OH.HCl$ in 25% CH_3COOH	Eh
D	0.02 M HNO_3 in 30% H_2O_2 1.2 M CH_3COONH_4 in 20% HNO_3	Eh
E	30% H_2O_2, HF, HCl	Eh

The rate at which the "total amount available for leaching" measured in the sequential chemical extraction is actually released into the environment is affected by the conditions of disposal/utilization, and by the bottom ash's resistance to chemical changes. Most important is its ability to neutralize acid additions, which was measured by extraction of eleven subsamples of ground waste, each with an increasing amount of nitric acid, for 48 hours. The pH's of the extracts were measured and plotted as a titration curve.

The German standard leachability test, and the Swiss leachate test (TVA, 1988) were performed as representative regulatory tests. They are practical procedures designed for estimating the leaching hazard associated with a waste in a short amount of time.

Both tests are batch tests of intact (ie. unground) waste material with distilled water at a liquid-to-solid ratio of 10:1. In the German test, the waste is allowed to establish the chemical environment in the extract, which is separated for analysis after 24 hours of tumbling. In the Swiss test, the waste is mixed with distilled water by sparging with CO_2. The dissolution of CO_2 in the water has the effect of lowering the pH, providing a more aggressive leaching environment. The protocol requires two successive 24 hour extractions of the waste material; the average of the concentrations measured in the two extracts, adjusted for the soluble fraction of the waste, is compared with regulatory limits.

In principle, the German leach test is intended to measure an initial leachate concentration (similar to the equilibrium extraction), while the Swiss test was designed to measure an amount available for leaching over a longer time period. However, the use of unground material and relatively short extraction periods in both tests causes the concentrations measured in the extract to be limited by the mass-transfer rate, in addition to the chemistry of the system. The resulting concentrations may be used as "numbers" for comparison with regulatory guidelines, but are not suitable for rigorous scientific evaluation of the potential for leaching.

To improve precision, triplicate measurements of loss on ignition and moisture content were performed, and the equilibrium extraction, the German standard leachability test and the Swiss leachate test were conducted in duplicate. The other tests were performed singly.

Chemical Analysis

Leachates and extracts were analyzed for heavy metals by Total X-ray Fluorescence Analysis (TXFA). This technique measures a number of elements simultaneously, but only chromium, copper, lead, nickel and zinc measurements are reported here. These were the only toxic contaminants found to be present in appreciable quantities in the solids. Cadmium, which could not be measured using the molybdenum X-ray tube, was measured separately using inverse voltametry.

Chloride and sulfate were measured in the leachates and extracts by ion chromatography.

The solids were analyzed for total carbon using a cerimetric method.

RESULTS AND DISCUSSION

Bottom Ash Composition

Figure 1 shows the total concentrations of cadmium, chromium, copper, lead, nickel, and zinc measured in the samples of Göppingen bottom ash analyzed approximately monthly, by the Göppingen regional authority. These figures do not show any trends in concentration as a function of time. Probability plot analysis of the data also showed the points to be

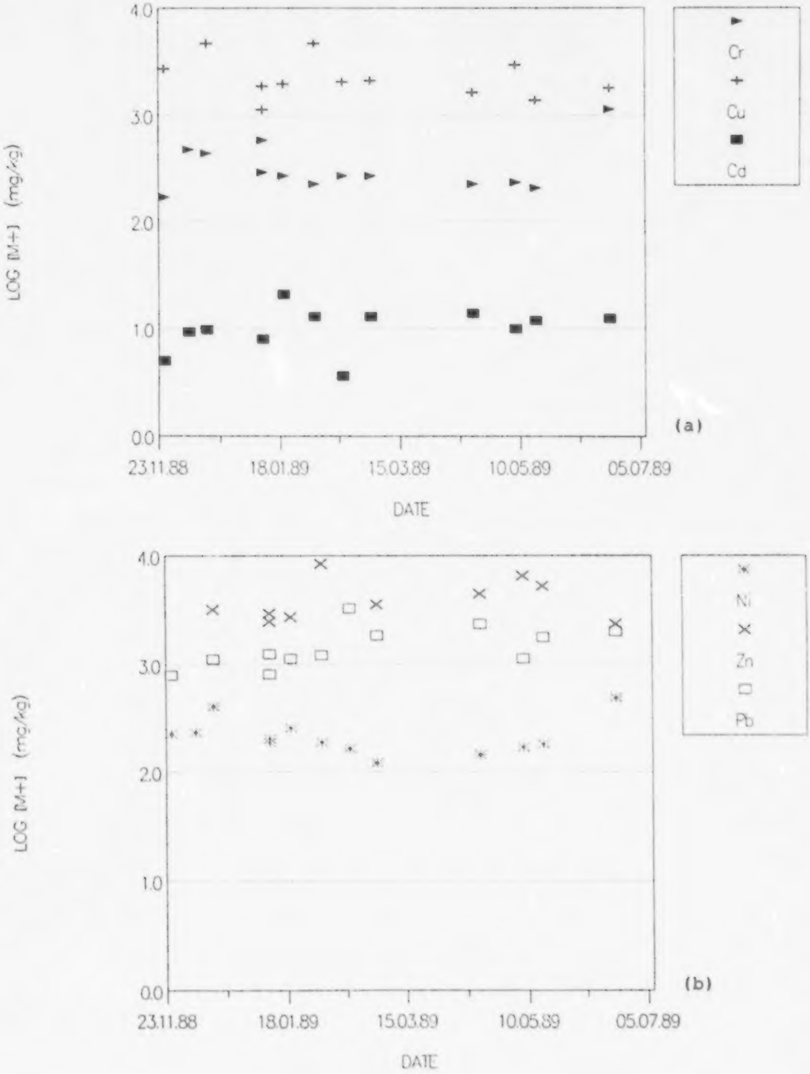


Figure 1: Total metal concentrations in Göppingen bottom ash vs time

approximately log - normally distributed, ie. the differences between analyses are attributable to random error. The geometric average concentrations, and the corresponding coefficients of variation are reported in Table 3. Heavy metal concentrations in the bottom ashes ranged from 10 mg/kg, in the case of cadmium, to 3900 mg/kg of zinc. The coefficients of variation calculated for the heavy metals were between 48 and 68%.

Table 3: Total Contaminant Concentrations in Untreated Bottom Ash

Parameter	Number of Analyses	Average Concentration (mg/kg, dry wt.)	Coefficient of Variation (%)
Cadmium	12	10	61
Chromium	13	320	68
Copper	12	2200	54
Lead	12	1400	54
Nickel	13	210	48
Zinc	10	3900	54
Chloride		3100	72
Sulfate		16000	121
Carbon (%)	2	1.7	54
Loss on Ignition (%)	2	3.9	74
Moisture Content (%)*	2	17.0	30

* wet weight basis

While the average concentrations measured were similar, the coefficients of variation for the metal concentrations measured in the four samples of bottom ash collected at the same time period, but different locations in the bottom ash heap, tended to be much lower, ranging from 9 to 54%. The increase in variability for samples taken at different time periods was shown to be statistically significant at the 95% significance level for copper and zinc. The higher variability may be partially attributed to analysis of the samples by different laboratories.

Average contaminant concentrations measured in samples treated by outdoor storage, or boiler ash separation are shown in Table 4.

Table 4: Contaminant Concentrations in Treated Bottom Ash

	OUTDOOR STORAGE			WITHOUT BOILER ASH		
Parameter	Number of Analyses	Average Concentration (mg/kg, dry wt.)	Coefficient of Variation (%)	Number of Analyses	Average Concentration (mg/kg, dry wt.)	Coefficient of Variation (%)
Cadmium	2	7.2	130	3	5.1	77
Chromium	2	790	15	3	760	16
Copper	2	1700	8	3	1800	46
Lead	2	1000	46	3	1100	23
Nickel	2	310	1	3	340	40
Zinc	2	3300	31	3	2300	24
Chloride	2	3200	21	3	2900	36
Sulfate	2	4000	11	3	8500	332
Carbon (%)	2	1.7	43	3	1.5	21
Loss on Ignition (%)	2	5.1	29	3	3.1	18
Moisture Content (%)*	2	9.2	24	3	16.1	6

* wet weight basis

Statistical comparison of bottom ash samples conditioned by outdoor storage with fresh bottom ash samples, using a t-test (Box et al., 1978), did not show any statistically significant differences in total concentrations of cadmium, copper, lead, zinc, chloride, sulfate, or carbon.

The moisture content of stored bottom ash was lower than that of fresh bottom ash, which results in improved handling characteristics from the point of view of utilization in road construction.

A t-test comparison of bottom ash samples with and without boiler ash showed that samples not containing boiler ash tended to have lower levels of cadmium and zinc, at the 60% significance level. Boiler ash separation did not effect a statistically significant decrease in total concentrations of copper, lead, chloride, sulfate, or carbon. Although the amount of boiler ash is generally only about 1% of the amount of bottom ash, past analyses have shown that it contains up to 30 times more cadmium, and 10 times more zinc than the bottom ash (Schneider, 1989).

The t-test also showed that higher levels of chromium and nickel were measured for both types of treated samples. This observation may be attributed to the different analytical techniques used by the LIT, and the laboratories that performed the bottom ash analyses in the past. In particular, there is evidence that use of a cobalt standard in TXRA can result in a slightly elevated nickel measurement.

The loss on ignition measurements for the three bottom ash types were not significantly different from one another. The recommended limit of 5% loss on ignition (LAGA Merkblatt, 1986) was exceeded by the stored bottom ash, but this is not a statistically significant, or theoretically explainable result.

Initial Leachate Concentration

The 7-day equilibrium extraction with distilled water was conducted only on the bottom ash with boiler ash at the time of sampling in January, 1989 and after 23 weeks of outdoor storage, and on one of the samples without bottom ash collected in November, 1989. Therefore there is no information about the variability of the concentrations measured in this test for samples of the same type of ash collected at different times.

The concentrations measured in the equilibrium extraction test for the three samples of waste tested are presented in Figure 2 in bar-chart format. Cadmium and chromium were below detection in all the leachates. The alkaline pH of the leachates ensured that the concentrations of the other heavy metals were low as well (usually below 0.5 mg/L). It appeared that less copper, lead and nickel were leached from the stored bottom ash, than from the fresh bottom ash, with or without boiler ash. Since only one sample of each of the three types of bottom ash was subjected to this test, it is not possible to determine whether the difference in this case is greater than would be expected by chance. However, the difference may be attributable to the lower pH of the stored bottom ash, which, at 9.5, is in the range of minimum solubility for amphoteric heavy metals (see Acid Neutralization Capacity, below).

As might be expected, the chloride concentrations in the equilibrium extracts show that nearly all of the chloride in the sample was dissolved.

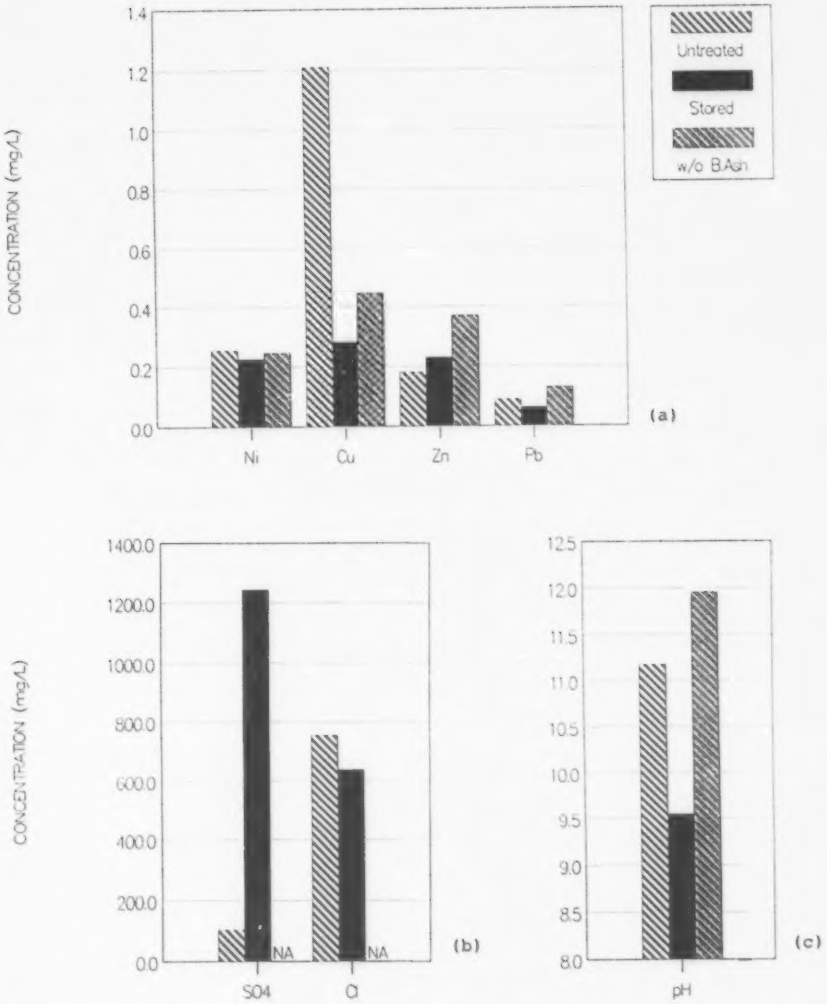


Figure 2: Concentrations measured in an equilibrium extraction

High concentrations of sulfate were also observed, although sulfate dissolution did not appear to be quantitative.

Amount Available for Leaching

The sequential chemical extraction was performed for four aliquots of untreated bottom ash, for the same bottom ash after 15 weeks of outdoor storage, and for two samples of bottom ash without boiler ash.

Figure 3 summarizes the amounts of cadmium, chromium, copper, lead and zinc measured in each successive fraction of the sequential chemical extraction, for the three types of bottom ash examined. The quantities of each heavy metal have been expressed as a percentage of the total concentration measured by total digestion and analysis. The additive total of the amounts measured in each fraction was not used as a basis for calculation of percentages to avoid carry-over of error from each fraction to the total. Consequently, the sum of the percentages may be greater or less than 100%, respectively indicating over or underestimation of the contaminant concentration in at least one fraction relative to the amount measured by total digestion and analysis.

In general, for all three types of bottom ash, it appears that:

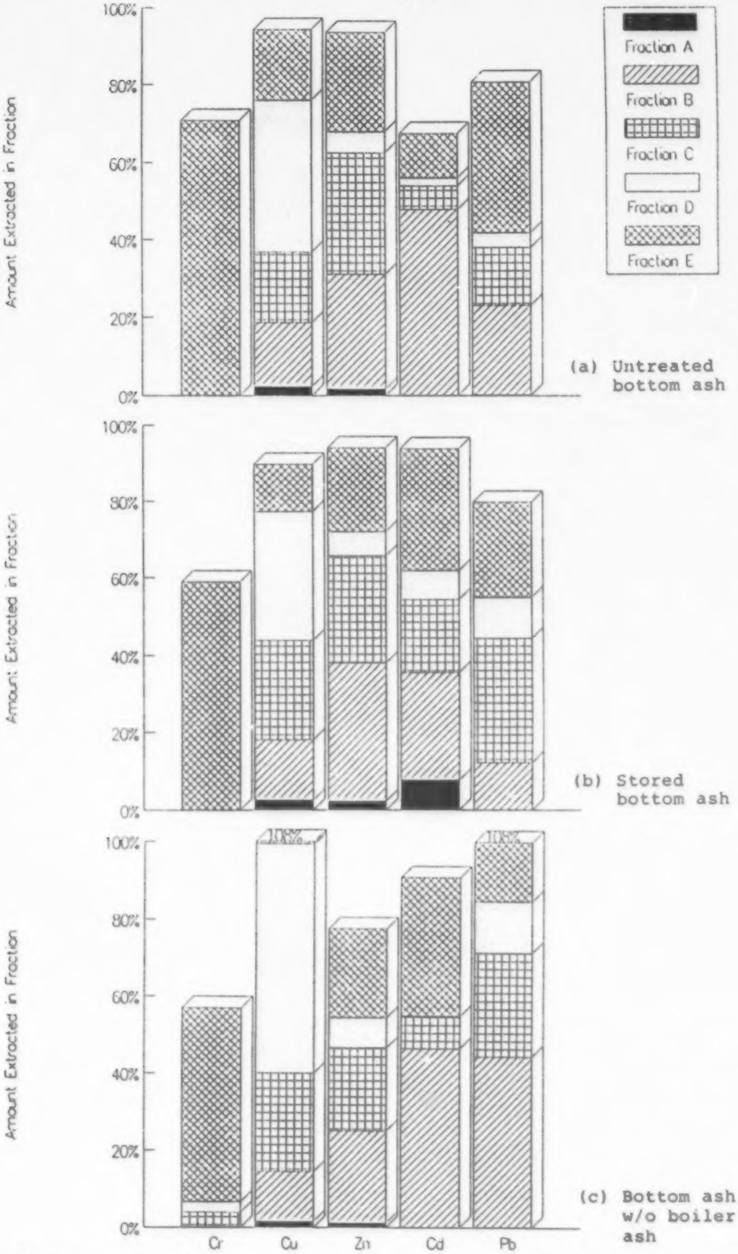
(i) Negligible quantities of all of the contaminants are found in fraction A, the fraction immediately available for leaching,

(ii) 15 to 50% of cadmium, copper, lead and zinc will be available for leaching over the longer term (i.e., are speciated in Fraction B),

(iii) 5 to 30% of cadmium, copper, lead and zinc are speciated in Fraction C, which is only available for leaching under very reducing conditions,

(iv) More than 30% of cadmium and zinc and 50% of copper and lead are present in the unleachable fractions D and E, and

(v) Chromium is virtually entirely contained in the most unleachable fraction (E).



(a) Untreated bottom ash

(b) Stored bottom ash

(c) Bottom ash w/o boiler ash

Figure 3: Partitioning of metals (sequential chemical extraction)

Furthermore, it appears that outdoor storage of the bottom ash may have resulted in some respeciation of cadmium and lead from Fraction B to Fraction C, although this observation could not be confirmed statistically. Coefficients of variation for the various contaminants in the five fractions ranged from 4 to 87%. It should be noted that these coefficients of variation are based on aliquots sampled at one time, rather than samples from different times. As this test is very labour-intensive, the variability of the results for different sampling times has yet to be determined.

No change in contaminant speciation was observed in the bottom ash without boiler ash, except possibly in the case of nickel. Nickel has been omitted from the plots, and the conclusions regarding it are tentative because the total concentration measured in the sequential chemical extraction exceeded that measured after total digestion by approximately 80%. However, a greater proportion of the nickel in the bottom ash without boiler ash appeared to be speciated in the unleachable fractions D and E, while in the two ashes containing boiler ash, the majority of nickel was found in fractions B and C. Since the total amount of nickel in the bottom ash containing boiler ash could not be shown to be greater than that in the bottom ash without boiler ash, this result can only be explained based on random differences in speciation between ashes generated several months apart.

For the untreated and stored ashes containing boiler ash, the plots for the remaining contaminants show that the total concentrations measured in the sequential chemical extraction tended to be from 5 to 40% lower than those measured after total digestion. Loss of contaminant may occur in the washing steps between fraction. Modification of the washing steps which were conducted for the bottom ash without boiler ash resulted in better recoveries for copper and lead.

Acid Neutralization Capacity

Titration curves for the three types of bottom ash have been plotted in Figure 4. For the untreated bottom ash, and the bottom ash conditioned by outdoor storage, the plotted data points represent the average of two measurements; for the bottom ash not containing boiler ash, the average of three measurements was plotted.

Figure 4 shows that all three types of bottom ash can neutralize about 2 meq of acid per gram, before reaching a neutral pH, where heavy metals will be more soluble. Thus, 1 kg of ash is capable of neutralizing approximately 20000 L of pH 4 groundwater.

It can also be seen from Figure 4 that the pH of the stored bottom ash is lower than that of the untreated bottom ash. This difference is statistically significant (based on a paired t-test at the 95% significance level), for acid additions of less than 2 meq per gram, i.e. in the high pH range. At acidic pH's, the response of both bottom ashes to acid addition appears to be similar. It is postulated that the excess alkalinity present in fresh bottom ashes may be neutralized by carbonation, and perhaps also consumed by alumino-silicate reactions, in the presence of water, during the outdoor storage period. If true, this has the advantage of providing an initial pH around 10, where heavy metal contaminants have their minimum solubility, in bottom ashes conditioned by outdoor storage. Most heavy metals are amphoteric and will be more soluble at the higher pH (approximately 11) of fresh bottom ashes. The initially lower pH of the stored bottom ashes does not have any drawbacks at the low end of the pH scale, after more acid is added, since the alkalinity is released upon acid addition and provides the same buffering capacity as the untreated bottom ash.

Also, based on a paired t-test, the pH's of the bottom ash not containing boiler ash were shown to be slightly lower than those of the untreated bottom ash in the low pH range, with acid additions of more than 2 meq

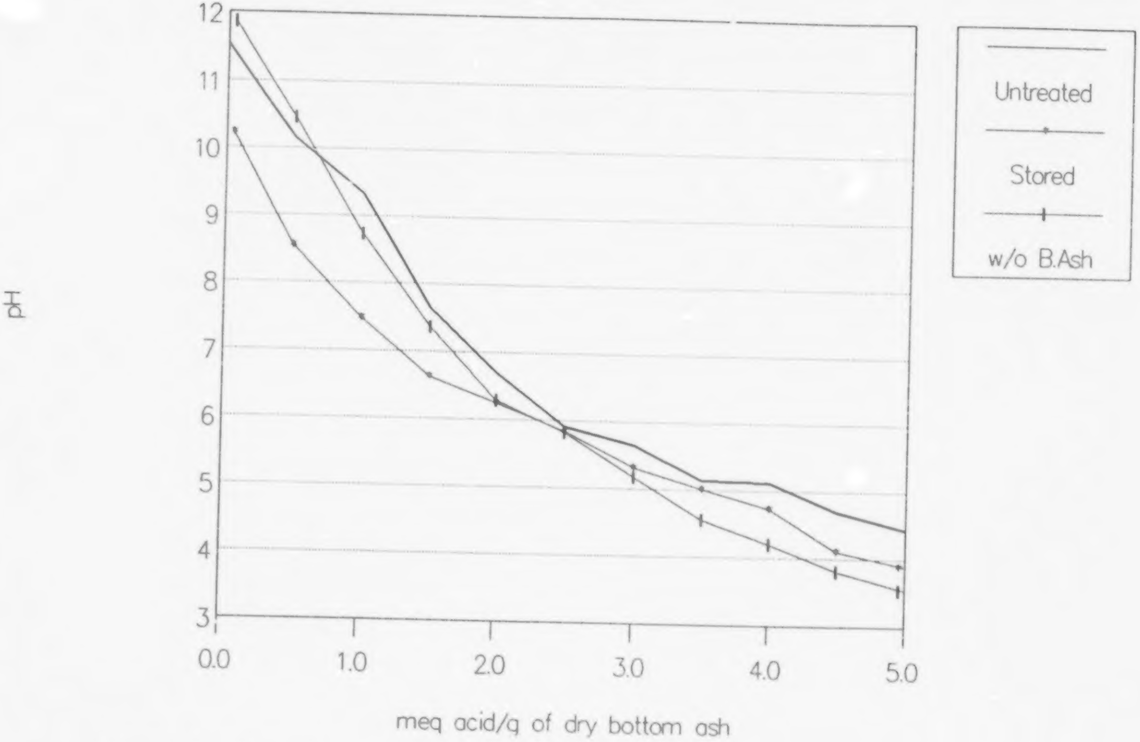


Figure 4: Titration curves for addition of nitric acid to bottom ash

per gram (this, in spite of a higher initial pH). This suggests that the boiler ash provides a small amount of additional acid neutralization capacity.

German Standard Leachability Test

The results of the routinely-conducted German standard leachability test are presented as a function of time in Figure 5. No trends with time are apparent, but the variability of the data is high. Coefficients of variation are reported in Table 5. It is notable that pH measurements appear to fall into two distinct groups, of approximately 12, and approximately 8. Measurements performed recently by the LIT indicate that the higher pH is more typical for fresh bottom ashes.

Table 5: Variability of Concentrations Measured in the German Standard Leachability Test for Untreated Bottom Ash Samples Collected at Different Times

Parameter	Coefficient of Variation (%)
pH	21
Copper	104
Lead	234
Nickel	69
Zinc	91
Chloride	113
Sulfate	966

Note: Cadmium and chromium were not detected.

Testing of the four samples of bottom ash collected at the same time, but from different locations in the bottom ash heap, showed that that bottom ash generated at the same time was more similar than bottom ashes generated at different times. This observation was found to be statistically significant at the 95% level for copper, zinc and chloride.

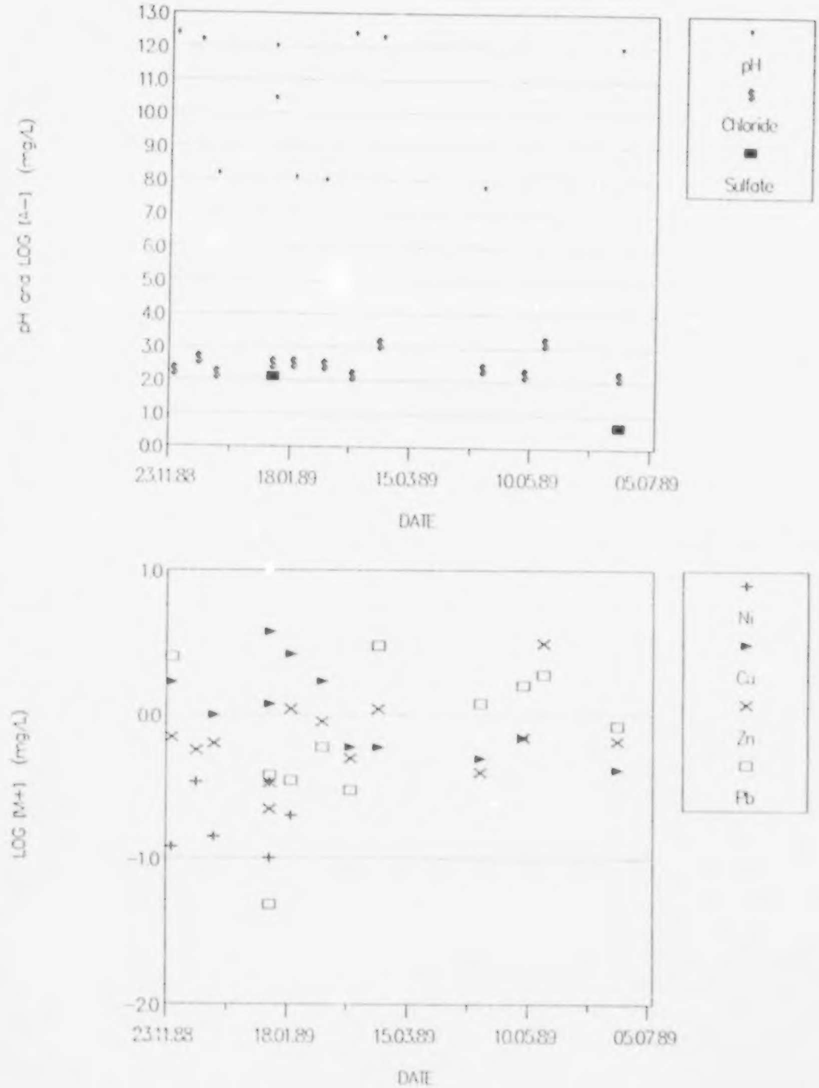


Figure 5: Concentrations measured in the German standard leachability test of Göppingen bottom ash vs time

Coefficients of variation ranged from less than 1%, for pH, to 169%, for sulfate.

Figure 6 presents the results from the German standard leachability test of the three types of bottom ash in bar-chart format. Cadmium and chromium were below detection in all of the leachates. The alkaline pH of the leachates ensured that the concentrations of the other heavy metals were low as well (below 3.5 mg/L). As might be expected, these results are not unlike those observed in the equilibrium extraction, although the concentration of lead measured here was several times higher than was measured in the equilibrium extraction. This observation may be a consequence of the relatively short extraction period of the German standard leachability test (24 h vs. 7 days in the equilibrium extraction). Often, a heavy metal dissolves initially, only to reprecipitate or be adsorbed as equilibrium is approached.

Again, it appears that less was leached from the stored bottom ash, than from the fresh bottom ash, with or without boiler ash. This observation was found to be statistically significant at the 60% level for copper and lead, and at the 75% level for zinc, using a t-test. It also appeared that more lead (at the 85% significance level) was leached from the bottom ash without boiler ash than from that containing boiler ash. Both of these observations may be attributed to the different pH's measured in the three leachates, which are shown in Figure 6(c). As mentioned earlier, amphoteric heavy metals (for example, lead) are least soluble at approximately pH 10, thus, the higher pH of the fresh bottom ashes resulted in higher concentrations of heavy metals in the leachates. The difference in the pH's of the bottom ashes with and without boiler ash was likely a natural variation in the bottom ash, rather than an effect of boiler ash separation, since the pH differences could not be shown to be statistically significant.

The concentrations of chloride and sulfate measured in the extracts for the three different types of bottom ash were not significantly different

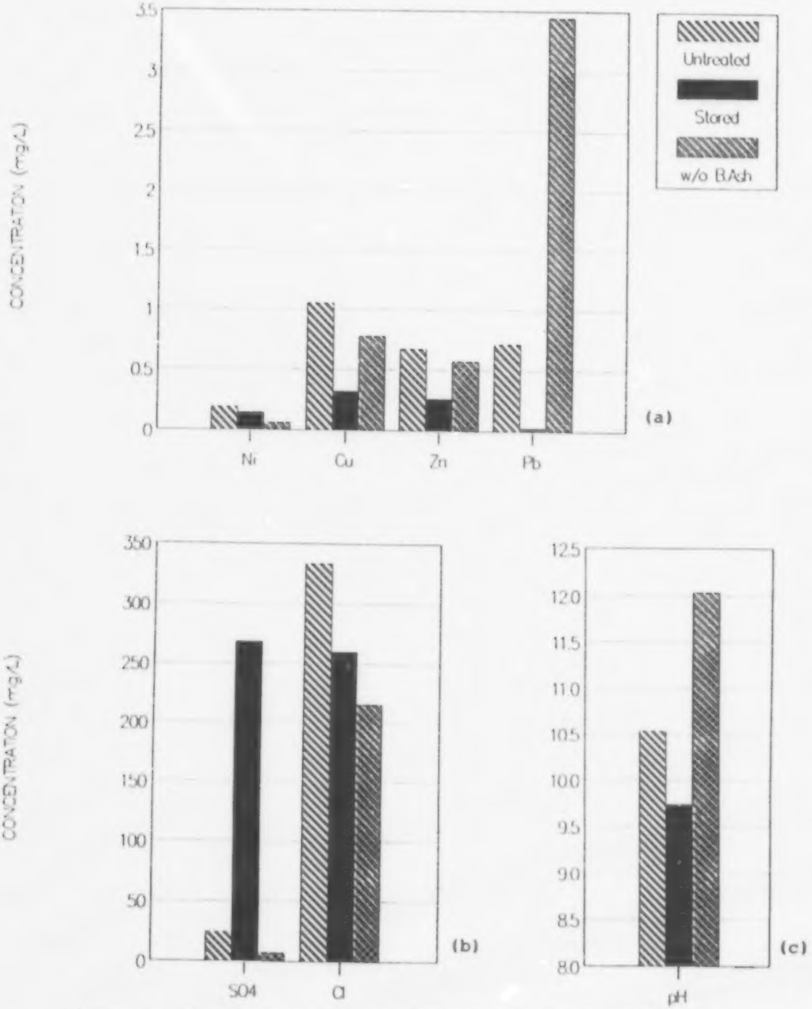


Figure 6: Concentrations measured in the German standard leachability test

from one another. The high solubility of these anions resulted in high concentrations in the leachates. The anion concentrations are lower than were measured in the equilibrium extraction because of dilution from the higher liquid to solid ratio in the German standard leachability test.

Measurement of total dissolved solids in the extracts showed these to be less than the maximum 2.0% recommended for utilization in road construction (FgSV Merkblatt, 1986).

Swiss Leachate Test

The results from the Swiss leachate test of the three types of bottom ash are presented in Figure 7, as a bar chart. The regulatory limits are also shown for comparison. The data presented are the average normalized concentrations from two successive 24 hour leaching intervals. pH and metal concentrations in the second leaching interval tended to remain the same or decrease very slightly with respect to concentrations measured in the first leaching interval. Chloride and sulfate levels in the second leaching interval decreased to between approximately 10 to 50% of their concentrations in the first leaching interval.

Testing of only two samples of untreated bottom ash from different sampling times was insufficient to reliably determine the variability with time, but testing of the four aliquots of bottom ash collected at the same time, but from different locations in the bottom ash heap showed that the spatial variability of the results from the Swiss leachate test was quite low with coefficients of variation ranging from 5%, for pH, to 54%, for zinc.

Because the leachate pH was reduced to about 6 by sparging with CO_2, metal concentrations are higher in the Swiss test leachates than in the German standard leachability test leachates. It is apparent that concentrations of cadmium, chromium and lead are still low, and lie safely below their regulatory limits. However, concentrations of nickel,

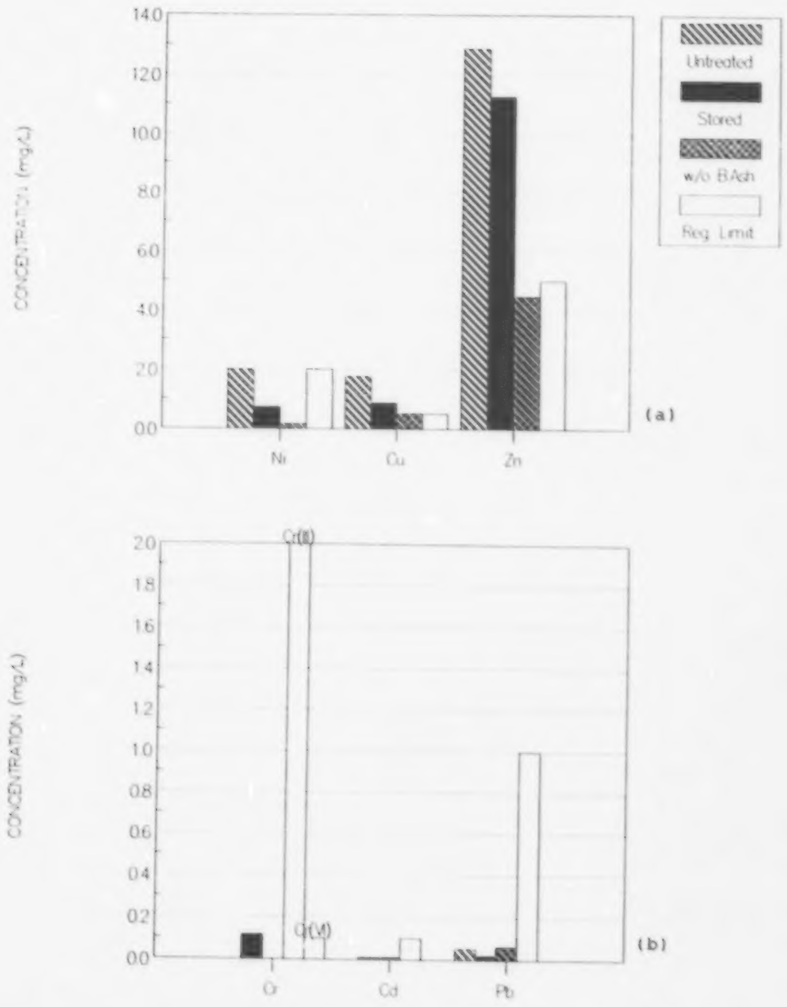


Figure 7: Concentrations measured in the Swiss Leachate Test

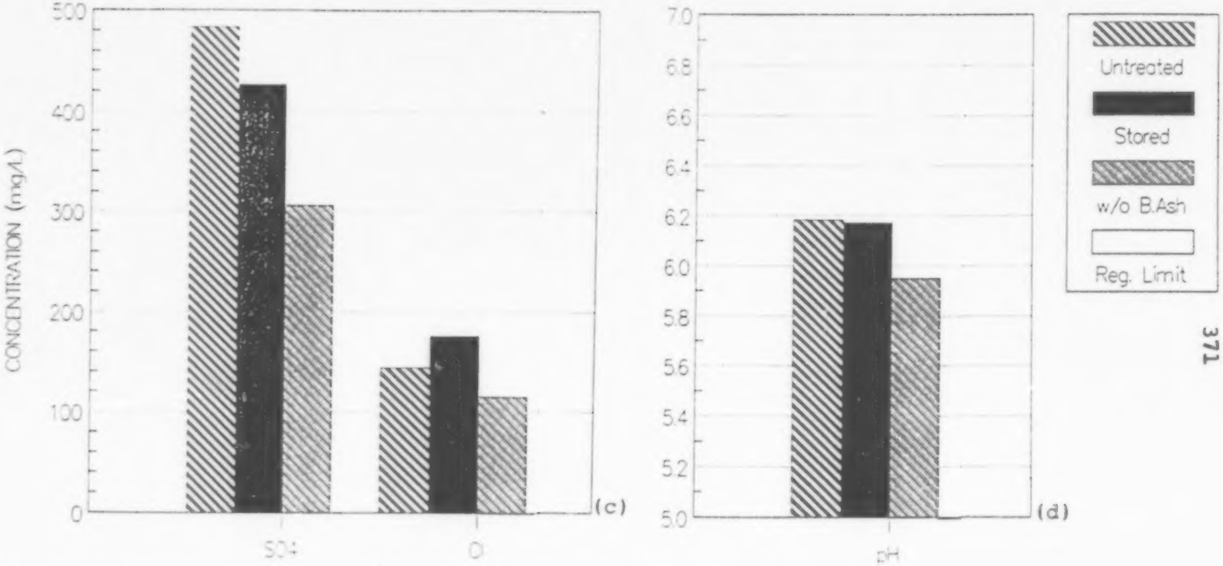


Figure 7 (continued): Concentrations measured in the Swiss leachate test copper, and especially zinc are higher, and are within the range of, or exceed their regulatory limits.

A t-test comparison showed no statistically significant difference between metal concentrations leached from the untreated and stored bottom ashes, however, the concentrations of nickel and zinc leached from the bottom ash without boiler ash could be shown to be lower, at the 90% significance level. For nickel, the decrease in leachability may be a consequence of a more refractory speciation which was also observed in the sequential chemical extraction.

Also statistically significant, although only at the 60% significance level, was the lower leachate pH for the bottom ash not containing boiler ash.

CONCLUSIONS

Bottom Ash Heterogeneity

On the basis of measurement of total contaminant concentrations and concentrations in the German standard leachability test, it was shown that the bottom ash generated at the Göppingen facility varies more over time than space. Characterization studies for bottom ash from a particular incinerator should take this into account; concerns regarding representative sampling should be directed at the temporal, rather than the spatial aspect. The coefficients of variation calculated can be used to compare bottom ashes generated at different incinerators, and to determine whether process changes have altered the quality of the bottom ash.

Outdoor Conditioning

Conditioning of the bottom ash by several months of outdoor storage did not affect the total amount of contaminant present in the ash, but did appear to have a beneficial effect on the initial leachability, and possibly also on the speciation of contaminants. It is postulated that carbonation and alumino-silicate reactions occur during the storage period which decrease its leachability by lowering the initial pH to the range where heavy metals have their minimum solubility. These pozzolanic reactions may also improve the structural suitability of the ash for utilization.

Boiler Ash Separation

Separation of the boiler ash from the bottom ash appeared to decrease the total amount of cadmium and zinc in the ash, but did not appear to affect the speciation of contaminants. A reduced leachability of zinc was observed in the Swiss leachate test, but not in the German standard leachability test.

The acid neutralization capacity appeared to have been reduced slightly by boiler ash separation.

Bottom Ash Leachability

As demonstrated in the equilibrium extraction and the German standard leachability test, the alkaline pH of bottom ash is likely to result in very low concentrations of heavy metals in the leachate generated in the short term (or as long as the alkaline pH is maintained).

A high capacity for neutralizing acid indicates that an alkaline pH, where metals are relatively insoluble, will be maintained in the long term.

The sequential chemical extraction showed that less than 50% of the heavy metals will be available for leaching, even after the acid neutralization capacity is used up, under the probable conditions of disposal or utilization. Based on the regulatory limits for the Swiss leachate test, chromium, cadmium and lead levels leached at the mildly acidic pH of 6 did not present any hazard, levels of nickel and copper were near the limit, and zinc levels tended to exceed the limit.

The high solubility, and relatively high concentrations of chloride and sulfate salts present in bottom ashes indicate that these could cause minor impairment of environmental quality in the very short term. This could be prevented, however, by removal of the salts from the bottom ash prior to utilization by a washing step.

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